TABLE 8.7—STANDARD RMC VALUES—Continued

"g Force"	RMC percentage			
	Warm soak		Cold soak	
	15 min. spin (percent)	4 min. spin (percent)	15 min. spin (percent)	4 min. spin (percent)
650	23.0	26.4	24.1	28.0

8.8 Calculate the corrected RMC value for each extractor test condition, $RMC_{cloth\text{-}corr}$ as follows:

$RMC_{cloth\text{-}corr} = A \times RMC_{cloth\text{-}avg} + B$

Where:

$RMC_{cloth\text{-}avg}$ = the average RMC value, as calculated in section 8.6 of this appendix for each extractor test condition, expressed as a decimal, and

A and B are the coefficients of the linear least squares fit as determined in section 8.7 of this appendix.

8.9 Calculate the root mean square error of the linear fit, RMSE. For test cloth lots qualified after February 18, 2025, the RMSE must be less than or equal to 0.012 for the test cloth lot to be considered acceptable. The RMSE is calculated as follows:

$$RMSE = \sqrt{\sum_{i=1}^{N} \frac{\left(RMC_{standard\_i} - RMC_{cloth-corr\_i}\right)^2}{N-2}}$$

Where:

$RMC_{standard\_i}$ = the $RMC_{standard}$ value in Table 8.7 of this appendix for the ith extractor test condition, expressed as a decimal,

$RMC_{cloth\text{-}corr\_i}$ = the corrected RMC value, as calculated in section 8.8 of this appendix for the ith extractor test condition, expressed as a decimal, and

N = the number of extractor test conditions listed in Table 8.7 of this appendix = 20.

* * * * *

[FR Doc. 2025–00986 Filed 1–16–25; 8:45 am]

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DEPARTMENT OF ENERGY

10 CFR Part 431

[EERE–2022–BT–TP–0019]

RIN 1904–AF08

Energy Conservation Program: Test Procedure for Compressors

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Final rule.

SUMMARY: The U.S. Department of Energy ("DOE") is amending the test procedure for compressors to correct an error and to ensure that pressure ratio is expressed in terms of absolute pressure. DOE is also correcting the formula for isentropic efficiency and specific energy consumption of the packaged compressor by incorporating a K_6 correction factor to correct for differences in pressure ratio when testing at differing elevations. Finally, DOE is amending the definition of "air compressor" to include a minor clarification and revise a typographical error.

DATES: The effective date of this rule is April 2, 2025. The amendments will be mandatory for product testing starting July 16, 2025.

The incorporation by reference of certain publications listed in the rule is approved by the Director of the Federal Register on April 2, 2025.

ADDRESSES: The docket, which includes **Federal Register** notices, public meeting attendee lists and transcripts, comments, and other supporting documents/materials, is available for review at *www.regulations.gov.* All documents in the docket are listed in the *www.regulations.gov* index. However, not all documents listed in the index may be publicly available, such as those containing information that is exempt from public disclosure.

A link to the docket web page can be found at *www.regulations.gov/docket/EERE-2022-BT-TP-0019.* The docket web page contains instructions on how to access all documents, including public comments, in the docket.

For further information on how to review the docket contact the Appliance and Equipment Standards Program staff at (202) 287–1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov.*

FOR FURTHER INFORMATION CONTACT:

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Mr. Pete Cochran, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 586–9496. Email: *Peter.Cochran@hq.doe.gov.*

SUPPLEMENTARY INFORMATION:

DOE incorporates by reference the following industry standards into title 10 of the Code of Federal Regulation ("CFR") part 431:

IEC 60584–1:2013, *Thermocouples—Part 1: EMF specifications and tolerances,* edition 3.0, August 2013 ("IEC 60584–1:2013").

IEC 60584–3:2021, Thermocouples—*Part 3: Extension and compensating cables—Tolerances and identification system,* edition 3.0, February 2021 ("IEC 60584–3:2021").

Copies of IEC 60584–1:2013 and IEC 60584–3:2021 may be purchased from International Electrotechnical Commission ("IEC") Central Office, 3, rue de Varembé, Case Postale 131, CH–1211, Geneva, Switzerland +41 22 919 02 11, or by going to *webstore.iec.ch.*

ISO 1217:2009(E), *Displacement compressors—Acceptance tests,* fourth edition, July 1, 2009 ("ISO 1217:2009(E)").

ISO 1217:2009/Amd.1:2016(E), *Displacement compressors—Acceptance tests* (fourth edition, July 1, 2009), AMENDMENT 1: Calculation of isentropic efficiency and relationship with specific energy, April 15, 2016 ("ISO 1217:2009/Amd.1:2016(E)").

ISO 5167–1:2022(E), *Measurement of fluid flow by means of pressure*

differential devices inserted in circular cross-section conduits running full—Part 1: General principles and requirements, third edition, June 2022 (''ISO 5167–1:2022(E)'').

ISO 9300:2022(E), *Measurement of gas flow by means of critical flow nozzles,* third edition, June 2022 (''ISO 9300:2022(E)'').

Copies of ISO 1217:2009(E), ISO 1217:2009/Amendment 1:2016(E), ISO 5167–1:2022(E), and ISO 9300:2022(E) may be purchased from International Organization for Standardization (''ISO'') at Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland +41 22 749 01 11, or by going to *www.iso.org.*

See section IV.N of this document for further discussion of these standards.

Table of Contents

I. Authority and Background

Compressors are included in the list of ''covered equipment'' (via the clause classifying certain types of ''industrial equipment'' as ''covered equipment'') for which the U.S. Department of Energy (''DOE'') is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6311(1)(L), 6311(2)(B)(i), and 6312(b)). DOE's test procedures for compressors are currently prescribed at subpart T of part 431 of title 10 of the Code of Federal Regulations (10 CFR part 431). The following sections discuss DOE's authority to establish and amend test procedures for compressors and relevant background information regarding DOE's consideration of test procedures for this equipment.

A. Authority

The Energy Policy and Conservation Act, Public Law 94–163, as amended (''EPCA''),[1] authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317, as codified) Title III, Part C of EPCA,[2] added by Public Law 95–619, Title IV, section 441(a), established the Energy Conservation Program for Certain Industrial Equipment, which sets forth a variety of provisions designed to improve energy efficiency. This equipment includes compressors, the subject of this document. Under EPCA, DOE may include a type of industrial equipment, including compressors, as covered equipment if it determines that doing so is necessary to carry out the purposes of Part A–1. (42 U.S.C. 6311(1)(L), 6311(2)(B)(i), and 6312(b)). The purpose of Part A–1 is to improve the efficiency of electric motors and pumps and certain other industrial equipment to conserve the energy resources of the Nation. (42 U.S.C. 6312(a)). On November 15, 2016, DOE published a final rule, which determined that coverage for compressors is necessary to carry out the purposes of Part A–1 of Title III of EPCA. 81 FR 79991. (42 U.S.C. 6311(1)(L); 42 U.S.C. 6311 (2)(A); 42 U.S.C. 6311 (2)(B)(i))

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA include definitions (42 U.S.C. 6311), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), energy conservation standards (42 U.S.C. 6313), and the authority to require information and reports from manufacturers (42 U.S.C. 6316; 42 U.S.C. 6296).

The Federal testing requirements consist of test procedures that manufacturers of covered equipment must use as the basis for: (1) certifying to DOE that their equipment complies with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6316(a); 42 U.S.C. 6295(s)), and (2) making other representations about the efficiency of that equipment (42 U.S.C. 6314(d)). Similarly, DOE must use these test procedures to determine whether the equipment complies with relevant standards promulgated under EPCA. (42 U.S.C. 6316(a); 42 U.S.C. 6295(s))

Federal energy efficiency requirements for covered equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a) and 42 U.S.C. 6316(b); 42 U.S.C. 6297). DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions of EPCA. 42 U.S.C. 6316(b)(2)(D).

Under 42 U.S.C. 6314, EPCA sets forth the criteria and procedures DOE must follow when prescribing or amending test procedures for covered equipment. EPCA requires that any test procedures prescribed or amended under this section must be reasonably designed to produce test results that reflect energy efficiency, energy use, or estimated annual operating cost of a given type of covered equipment during a

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116–260 (Dec. 27, 2020), which reflect the last statutory amendments that impact Parts A and A–1 of EPCA.

[2] For editorial reasons, upon codification in the U.S. Code, Part C was redesignated Part A–1.

representative average use cycle (as determined by the Secretary) and requires that test procedures not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(2))

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered equipment, including compressors, to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures to not be unduly burdensome to conduct and be reasonably designed to produce test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle. (42 U.S.C. 6314(a)(1))

In addition, if the Secretary determines that a test procedure amendment is warranted, the Secretary must publish proposed test procedures in the **Federal Register** and afford interested persons an opportunity (of not less than 45 days' duration) to present oral and written data, views, and arguments on the proposed test procedures. (42 U.S.C. 6314(b)) If DOE determines that test procedure revisions are not appropriate, DOE must publish its determination not to amend the test procedures. (42 U.S.C. 6314(a)(1)(A)(ii))

DOE is publishing this final rule in satisfaction of the 7-year review requirement specified in EPCA. (42 U.S.C. 6314(b)(1))

B. Background

DOE's existing test procedure for compressors appears at title 10 of the Code of Federal Regulations (CFR) part 431, subpart T, appendix A—Uniform Test Method for Certain Air Compressors (hereafter ''appendix A'').

As stated, DOE published a final rule on November 15, 2016, in which DOE determined that coverage of compressors is necessary to carry out the purposes of Part A–1 of Title III of EPCA. 81 FR 79991. DOE's test procedure for determining compressor energy efficiency of certain varieties of compressors was established in a final rule published on January 4, 2017 (hereafter, the ''January 2017 Final Rule''). 82 FR 1052.

On May 17, 2019, DOE published a notice of petition for rulemaking and request for comment regarding the test procedure for compressors in response to a petition from Atlas Copco North America (''Atlas Copco''). 84 FR 22395. Atlas Copco's petition was received on April 17, 2019. Atlas Copco requested that DOE amend the compressors test procedure to specify that manufacturers could satisfy the test procedure requirements by using the industry test method for rotary air compressor energy efficiency, ISO 1217:2009(E) ''Displacement compressors—Acceptance tests''. In the notice of petition for rulemaking, DOE sought comment as to whether to proceed with the petition, but took no position at the time regarding the merits of the suggested rulemaking or the assertions made by Atlas Copco. 84 FR 22395.[3]

On January 10, 2020, DOE published a final rule for energy conservation standards for air compressors (hereafter, the ''January 2020 ECS Final Rule''). 85 FR 1504. Compliance with the energy conservation standards established in the January 2020 ECS Final Rule is required for compressors manufactured starting on January 10, 2025. 10 CFR 431.345.

On May 6, 2022, DOE issued a Request for Information (''RFI'') for a test procedure for compressors to consider whether to amend DOE's test procedure for compressors (hereafter, the ''May 2022 RFI''). 87 FR 27025. To inform interested parties and to facilitate this process, DOE identified certain issues associated with the currently applicable test procedure on which DOE is interested in receiving comment. On June 6, 2022, DOE granted a 14-day extension to the public comment period, allowing comments to be submitted until June 20, 2022. 87 FR 34220.

In general, representations of compressor performance must be in accordance with the DOE test procedure. (42 U.S.C. 6314(d)). However, DOE guidance (issued Dec. 6, 2017; revised Jun. 8, 2018) stated that it would discretionarily not enforce this requirement until compliance with a standard is required or a labeling requirement is established. On May 2, 2022, DOE announced that it was suspending the enforcement policy regarding the test procedure for air compressors and removed the policy from the DOE enforcement website.

Following retraction of the enforcement policy and to aid manufacturers in understanding DOE's regulatory requirements regarding the test procedure and forthcoming energy conservation standards, DOE held a ''Compressors Regulations 101'' webinar on May 24, 2022. The webinar reviewed testing, rating, certification, and compliance responsibilities.[4]

On February 13, 2023, DOE published a notice of proposed rulemaking and announcement of public meeting for test procedures for compressors (hereafter, the ''February 2023 NOPR''). 88 FR 9199. To inform interested parties and to facilitate this process, DOE identified certain issues associated with the currently applicable test procedure on which DOE is interested in receiving comment. On March 22, 2023, DOE held a public meeting (hereafter, the ''March 2023 Public Meeting'') to obtain stakeholder input regarding the issues and proposed amendments raised by the February 2023 NOPR.

DOE received comments in response to the February 2023 NOPR from the interested parties listed in table I.1.

TABLE I.1—LIST OF COMMENTERS WITH WRITTEN SUBMISSIONS IN RESPONSE TO THE FEBRUARY 2023 NOPR

Commenter(s)	Reference in this final rule	Comment No. in the docket	Commenter type
Compressed Air & Gas Institute	CAGI	21	Trade Association.
Saylor-Beall Air Compressors	Saylor-Beall	22	Manufacturer.
Sullivan-Palatek, Inc	Sullivan-Palatek	23	Manufacturer.
Kaeser Compressors	Kaeser Compressors	24	Manufacturer.
Ingersoll Rand	Ingersoll Rand	25	Manufacturer.
Northwest Energy Efficiency Alliance, and Northwest Power and Conservation Council.	NEEA & NPCC	26	Efficiency Organizations.
Pacific Gas and Electric Company, San Diego Gas and Electric, and Southern California Edison.	CA IOUs	27	Utility Companies.

[3] Associated documents are available in the rulemaking docket at *www.regulations.gov/docket/EERE-2019-BT-PET-0017.*

[4] The slide material presented during the webinar has been published on DOE's website: *www.energy.gov/sites/default/files/2022-05/compressors-101.pdf.*

TABLE I.1—LIST OF COMMENTERS WITH WRITTEN SUBMISSIONS IN RESPONSE TO THE FEBRUARY 2023 NOPR—Continued

Commenter(s)	Reference in this final rule	Comment No. in the docket	Commenter type
Appliance Standard Awareness Project, American Council for an Energy-Efficient Economy, and Natural Resources Defense Council.	ASAP, ACEEE, & NRDC	28	Efficiency Organizations.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[5] To the extent that interested parties have provided written comments that are substantively consistent with any oral comments provided during the March 2023 Public Meeting, DOE cites the written comments throughout this final rule. DOE did not identify any oral comments provided during the March 2023 Public Meeting that are not substantively addressed by written comments.

II. Synopsis of the Final Rule

In this final rule, DOE is amending subpart T of title 10 of the Code of Federal Regulations, part 431 (10 CFR part 431), which contains definitions, materials incorporated by reference, and the test procedure for determining the energy efficiency of certain varieties of compressors, as follows:

(1) Correct the formula for calculating isentropic efficiency and specific energy consumption of the packaged compressor by incorporating a K6 correction factor to correct for the change in pressure ratio when testing at differing elevations;

(2) Revise the formula for pressure ratio at full-load operating pressure currently in 10 CFR part 431, subpart T to correct a typographical error, and to calculate pressure ratio using terms expressed in absolute pressure; and

(3) Modify the current definition of ''air compressor'' to clarify that compressors with more than one compression element are still within the scope of this test procedure, and to revise the typographical error of ''compressor element'' to ''compression elements.''

DOE's actions are summarized in table II.1 compared to the current test procedure as well as the reason for the proposed change.

TABLE II.1—SUMMARY OF CHANGES IN AMENDED TEST PROCEDURE

DOE test procedure prior to amendment	Amended test procedure	Attribution
References ISO 1217:2009(E) Annex C (excluding sections C.1.2, C.2.1, C.3, C.4.2.2, C.4.3.1, and C.4.5) for calculating isentropic efficiency and specific energy consumption of the packaged compressor.	Adds the K_6 correction factor in the formula calculating isentropic efficiency and specific energy consumption of the packaged compressor in order to correct for the change in pressure ratio when testing at differing elevations. Incorporates by reference Annex B, section B.4.5 of ISO 1217:2009(E).	Error correction.
Pressure ratio at full-load operating pressure formula in 10 CFR part 431, subpart T contains an error, as the wrong formula is presented.	Corrects the pressure ratio at full-load operating pressure formula in 10 CFR part 431, subpart T.	Error correction.
Air Compressor Definition: A compressor designed to compress air that has an inlet open to the atmosphere or other source of air, and is made up of a compression element (bare compressor), driver(s), mechanical equipment to drive the compressor element, and any ancillary equipment.	Air Compressor Definition: A compressor designed to compress air that has an inlet open to the atmosphere or other source of air, and is made up of one or more compression elements (bare compressors), driver(s), mechanical equipment to drive the compression elements, and any ancillary equipment.	Clarification.

DOE has determined that the amendments described in section III and adopted in this document will more accurately comply with the requirements that test procedures be reasonably designed to produce test results that reflect energy use during a representative average use cycle and are not unduly burdensome to conduct. (42 U.S.C. 6314(a)(2)) The amendments adopted in this final rule will ensure that any test for isentropic efficiency and specific energy consumption of a packaged compressor performed at any elevation other than 364 ft, or during low- or high-pressure weather events, will be correct. As such, these amendments will ensure accurate measured/calculated efficiency of compressors. DOE has also determined that these amendments will not require retesting or recertification solely as a result of DOE's adoption of the amendments to the test procedures since the amendment aligns the test procedure with existing industry practice. Additionally, DOE has determined that the amendments will not increase the cost of testing. Discussion of DOE's actions are addressed in detail in section III of this document.

The effective date for the amended test procedures adopted in this final rule is 75 days after publication of this document in the **Federal Register**. Representations of energy use or energy efficiency must be based on testing in accordance with the amended test procedures beginning 180 days after the publication of this final rule.

III. Discussion

In the following sections, DOE adopts certain amendments to its test procedure for compressors. For each amendment, DOE provides relevant background information, explains why

[5] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop test procedures for compressors. (Docket No. EERE–2022–BT–TP–0019, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

the amendment merits consideration, discusses relevant public comments, and adopts an approach.

A. Scope of Applicability

DOE's test procedure applies to a compressor that meets all of the following criteria: is an air compressor; is a rotary compressor; is not a liquid ring compressor; is driven by a brushless electric motor; is a lubricated compressor; has a full-load operating pressure of 75–200 pounds per square inch gauge (psig); is not designed and tested to the requirements of the American Petroleum Institute Standard 619; has full-load actual volume flow rate greater than or equal to 35 cubic feet per minute (cfm), or is distributed in commerce with a compressor motor nominal horsepower greater than or equal to 10 horsepower (hp); and has a full-load actual volume flow rate less than or equal to 1,250 cfm, or is distributed in commerce with a compressor motor nominal horsepower less than or equal to 200 hp. 10 CFR 431.344.

DOE received comments both supporting and opposing scope changes. CAGI, supported by Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek, stated that they support DOE's proposal to maintain the current scope of the test procedure. (CAGI, No. 21 at pp. 1–3; Kaeser Compressors, No. 24 at pp. 3–5; Ingersoll Rand, No. 25 at pp. 1–3; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1) On the other hand, NEEA & NPCC, CA IOUs, and ASAP, ACEEE, & NRDC encouraged DOE to consider expanding the scope of the test procedure to include additional air compressor types. (NEEA & NPCC, No. 26 at pp. 2–4; CA IOUs, No. 27 at pp. 2–9; ASAP, ACEEE, & NRDC, No. 28 at pp. 1–3)

As discussed in more detail in the following sections, DOE is not amending the scope of the test procedure at this time. DOE may consider test procedure scope expansion, including related comments discussed in this final rule, in a future test procedure rulemaking.

DOE responds to specific scope expansion topics in sections III.A.1 through III.A.7 of this final rule.

1. Reciprocating Compressors

As stated in section III.A of this document, the current test procedure for compressors applies to rotary compressors (and, therefore, does not apply to reciprocating compressors). 10 CFR 431.344. In the February 2023 NOPR, DOE proposed to continue excluding reciprocating compressors from the scope of the test procedure. 88 FR 9199, 9203. DOE stated that it will continue reviewing potential test procedures for reciprocating compressors, including existing test methods, and may consider expanding the scope of the test procedure to include these compressors in a future test procedure rulemaking. *Id.* DOE also asked for comment regarding its proposal to not include reciprocating compressors within the scope of test procedure applicability. *Id.*

In response to the February 2023 NOPR, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all expressed support for the DOE proposal to exclude reciprocating compressors from the scope of test procedure applicability. (CAGI, No. 21 at p. 1; Kaeser Compressors, No. 24 at p. 3; Ingersoll Rand, No. 25 at p. 1; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1)

However, in response to the request for comment, NEEA & NPCC recommended that DOE modify the proposed test procedure or develop a new test procedure for testing both one- and three-phase reciprocating compressors because ISO 1217:2009(E) contains a commonly used test procedure for rating reciprocating compressors among manufacturers. However, NEEA & NPCC commented that the reasons discussed in the February 2023 NOPR (88 FR 9199, 9202) for DOE not using ISO 1217:2009(E), as currently written, as the test method for reciprocating compressors are reasonable. NEEA & NPCC also stated that, by establishing a test procedure for reciprocating compressors, DOE is ensuring consistent representation of efficiency in this market and creating a path for industry stakeholders to gather data on this equipment type that would better inform future rulemakings. (NEEA & NPCC, No. 26 at pp. 2–3) ASAP, ACEEE, & NRDC agreed with this point and added that, given the significant potential energy savings for reciprocating compressors, DOE should consider the inclusion of reciprocating compressors within the test procedure scope. ASAP, ACEEE, & NRDC also stated that this would make it easier for DOE to pursue future energy conservation standards for reciprocating compressors and could provide helpful efficiency data to support voluntary programs. (ASAP, ACEEE, & NRDC, No. 28 at pp. 2–3)

DOE agrees that there could be benefits to including reciprocating compressors within the scope of the test procedure. DOE also agrees that the test method in ISO 1217:2009(E) might be appropriate for some reciprocating compressors but inappropriate for others, as there are a wide range of intended duty cycles for reciprocating compressors.

DOE is continuing to exclude reciprocating compressors from the scope of the compressors test procedure. DOE will continue reviewing potential test procedures for reciprocating compressors, including existing test methods, and may consider expanding the scope of the test procedure to include reciprocating compressors in a future test procedure rulemaking.

2. Centrifugal Compressors

As stated in section III.A of this document, the current test procedure for compressors applies to rotary positive displacement compressors (and therefore does not apply to centrifugal air compressors). 10 CFR 431.344. In the February 2023 NOPR, DOE proposed to continue excluding centrifugal compressors from the scope of the test procedure. 88 FR 9199, 9203. DOE stated that it will continue to review and consider potential test methods for centrifugal compressors and may consider developing test procedures for centrifugal compressors as a part of a future rulemaking process. *Id.* DOE also asked for comment regarding its proposal to not include centrifugal compressors within the scope of test procedure applicability and regarding whether dynamic compressor varieties other than centrifugal compete with the air compressor categories discussed in the February 2023 NOPR. *Id.*

In response to the request for comment in the February 2023 NOPR, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all expressed support for DOE's proposal to exclude centrifugal compressors from the scope of test procedure applicability. (CAGI, No. 21 at p. 2; Kaeser Compressors, No. 24 at p. 3; Ingersoll Rand, No. 25 at p. 1; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1) Additionally, in response to the request for comment regarding clarification on ''dynamic'' versus ''centrifugal'' compressors, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all supported the position that centrifugal compressors are the only form of dynamic compressor that competes with the air compressor categories discussed in the February 2023 NOPR. (CAGI, No. 21 at p. 2; Kaeser Compressors, No. 24 at p. 3; Ingersoll Rand, No. 25 at p. 2; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1)

NEEA & NPCC also recommended that DOE consider a separate future test

procedure rulemaking for centrifugal compressors, which would create a path for expanding the current test procedure scope to rotary compressors up to 500 hp. NEEA & NPCC commented that centrifugal compressors make up a small market share but represent 18 percent of annual energy consumption for industrial compressors, and are typically above 200 hp. NEEA & NPCC also stated that rotary and centrifugal compressors from 200 hp to 500 hp represent 25 percent of total commercial and industrial compressor energy consumption. NEEA & NPCC stated that ISO 5389 is an industry-accepted test procedure for centrifugal compressors and recommended this as an option for a future centrifugal compressor test procedure rulemaking. NEEA & NPCC also stated that there is little overlap in the applications that would use a centrifugal compressor instead of a rotary compressor because centrifugal compressors are more expensive and are used for specific applications that require clean air. (NEEA & NPCC, No. 26 at pp. 3–4)

CA IOUs recommended DOE expand the scope of this test procedure to cover centrifugal compressors. CA IOUs stated that dynamic air compressors account for approximately 18 percent of total industrial air compressor national energy consumption. CA IOUs also stated that the inclusion of dynamic compressors would give end users more data to compare with and that these compressors provide oil- and particulate-free air, which would allow them to compete with regulated and large positive displacement rotary compressors in certain applications. (CA IOUs, No. 27 at pp. 7–9) ASAP, ACEEE, & NRDC also encouraged DOE to include centrifugal compressors in the scope of this test procedure final rule due to the significance of their energy usage and the fact that centrifugal compressors may compete with large rotary positive displacement compressors. ASAP, ACEEE, & NRDC added that ISO 5389, the industry test procedure for dynamic compressors, could potentially serve as the basis of the test procedure. (ASAP, ACEEE, & NRDC, No. 28 at p. 3)

It is true that centrifugal compressors can compete with large rotary positive displacement compressors, as stated by commenters. (CA IOUs, No. 27 at pp. 8–9; ASAP, ACEEE, & NRDC, No. 28 at p. 3) DOE discussed the potential for competition between these categories in the January 2017 Final Rule. 82 FR 1052, 1061–1063. Competition between these categories is considerable above 200 hp, and this reasoning was used to set the upper bound of the compressor test procedure motor nominal horsepower at 200 hp. 82 FR 1052, 1062. As discussed in section III.A.3 of this final rule, DOE is maintaining this upper bound on compressor motor nominal horsepower in the test procedure. This ensures that there is not considerable competition between unregulated centrifugal compressors and regulated positive displacement rotary compressors within the scope of the DOE compressors test procedure.

DOE has not yet determined a test procedure for centrifugal compressors that would produce test results that reflect efficiency during a representative average use cycle and that would not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(2)) Due to the reasons discussed in the February 2023 NOPR and previous paragraphs, DOE is not expanding the scope of this test procedure to include centrifugal compressors. DOE continues to review and consider potential methods for centrifugal compressors and may consider developing test procedures for centrifugal compressors as part of a future rulemaking process.

3. Compressor Motor Nominal Horsepower

As stated in section III.A of this document, the current test procedure for compressors applies to compressors that have a full-load operating pressure of 75 to 200 psig (inclusive) and either (1) a full-load actual volume flow rate of 35 to 1,250 cfm (inclusive) or (2) compressor motor nominal horsepower of 10 to 200 hp (inclusive). 10 CFR 431.344. In the February 2023 NOPR, DOE tentatively determined that the same burden concerns as discussed in the January 2017 Final Rule would continue to exist for the current compressor market. 88 FR 9199, 9203. These include a small number of shipments of units greater than 200 hp and the potential for competitive disadvantage for rotary positive displacement compressors that compete with centrifugal compressors. *Id.* Therefore, DOE did not propose any changes to the current horsepower range of 10 to 200 hp for the existing test procedure in the February 2023 NOPR. *Id.* DOE asked for comment regarding the determination to not include compressors with a horsepower rating above 200 hp within the scope of test procedure applicability. *Id.*

In response to the February 2023 NOPR, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all expressed support for the DOE proposal to not include compressors with a horsepower rating above 200 hp within the scope of test procedure applicability. (CAGI, No. 21 at p. 2; Kaeser Compressors, No. 24 at pp. 3–4; Ingersoll Rand, No. 25 at p. 2; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1)

Kaeser Compressors encouraged DOE to investigate increasing the maximum horsepower above 200 hp to 500 hp in a future rulemaking. (Kaeser Compressors, No. 24 at p. 2) NEEA & NPCC recommended that DOE consider a separate future test procedure rulemaking for centrifugal compressors, which would create a path for expanding the current test procedure scope to rotary compressors up to 500 hp. NEEA & NPCC also stated that rotary and centrifugal compressors from 200 hp to 500 hp represent 25 percent of total commercial and industrial compressor energy consumption. (NEEA & NPCC, No. 26 at pp. 3–4)

CA IOUs recommended that DOE expand the scope of the test procedure to cover large (201–500 hp) rotary positive displacement air compressors. CA IOUs stated that all compressor types in this size range consume 29 percent of total industrial air compressor energy, and that increasing the scope of the test procedure would support the goal of fully evaluating the cost-effectiveness, technological feasibility, and economically justified savings opportunities for end users. CA IOUs also stated that air compressor manufacturers voluntarily provide CAGI data sheets for large and oil-free rotary positive displacement air compressors, therefore the additional test burden of covering compressors with motors operating at 201–500 hp is limited. CA IOUs provided data showing that there is a wide range of isentropic efficiencies for rotary positive displacement compressors with motor nominal power greater than 200 hp. Finally, CA IOUs provided data indicating that centrifugal compressors likely compete with fixed-speed rotary positive displacement compressors to provide baseload, but they do not likely compete with variable-speed rotary positive displacement compressors providing low part load. (CA IOUs, No. 27 at pp. 2–7)

ASAP, ACEEE, & NRDC also encouraged DOE to expand the scope of the test procedure to cover rotary positive displacement air compressors greater than 200 hp. ASAP, ACEEE, & NRDC disagreed with DOE's rationale for excluding rotary compressors greater than 200 hp for several reasons. First, ASAP, ACEEE, & NRDC indicated that CAGI performance data is already available for many of these larger models. Second, ASAP, ACEEE, & NRDC acknowledged that larger

compressors have lower shipment numbers, but they indicated that DOE has recently expanded the scope of the electric motors test procedure to 750 hp and stated that very large electric motors are also often low-volume, custom products. Third, ASAP, ACEEE, & NRDC stated that most compressor manufacturers make both in-scope rotary compressors and out-of-scope compressors, so it is unclear whether certain manufacturers would be disadvantaged by inclusion of larger rotary compressors. Finally, ASAP, ACEEE, & NRDC stated that DOE should consider expanding the test procedure scope to currently out-of-scope compressor types, such as centrifugal compressors, as this would mitigate concerns over disadvantaging certain manufacturers or pushing the market towards out-of-scope substitutions. (ASAP, ACEEE, & NRDC, No. 28 at pp. 1–2)

DOE recognizes that a considerable amount of the market for compressors greater than 200 hp is served by centrifugal compressors. As discussed in the January 2017 Final Rule, the inclusion of rotary compressors greater than 200 hp could create a competitive disadvantage for manufacturers of these compressors, as centrifugal compressors of the same horsepower do not have the same testing and representation requirements. 82 FR 1052, 1061–1062. DOE concluded at the time that this competitive advantage could incentivize users to switch from regulated rotary compressors to unregulated centrifugal compressors, thus creating a competitive advantage for manufacturers of unregulated centrifugal compressors. *Id.* Although commenters have indicated that these categories compete in only a subset of the market and that some manufacturers make both regulated and unregulated compressors, the same competitive issues still largely exist today.

Although ASAP, ACEEE, & NRDC have suggested that DOE can mitigate the concerns over competition by covering both rotary positive displacement and centrifugal compressors over 200 hp in the test procedure scope (ASAP, ACEEE, & NRDC, No. 28 at pp. 1–2), section III.A.2 of this final rule discusses that DOE is continuing to exclude centrifugal compressors from the scope of the test procedure at this time. As a result, in order to ensure that there is not considerable competition between unregulated centrifugal compressors and regulated positive displacement rotary compressors, DOE is also continuing to exclude rotary positive displacement compressors over 200 hp from the scope of the test procedure at this time.

For the reasons discussed in the February 2023 NOPR and the previous paragraphs, DOE is maintaining the current horsepower range of 10 to 200 hp for this test procedure final rule. DOE continues to review and consider potential methods for testing positive displacement rotary compressors with nominal motor horsepower greater than and less than the current scope and may consider developing test procedures for these compressors as part of a future rulemaking process.

4. Lubricant-Free Compressors

As stated in section III.A of this document, the current test procedure for compressors applies to lubricated compressors (and therefore does not apply to lubricant-free compressors). 10 CFR 431.344. In the February 2023 NOPR, DOE proposed to not expand the scope of the test procedure to include lubricant-free compressors. 88 FR 9199, 9203–9204. DOE stated that it may evaluate the justification for developing test procedures for lubricant-free compressors as part of a future rulemaking process. DOE also asked for comment regarding its proposal to not include lubricant-free compressors within the scope of test procedure applicability.

In response to the request for comment, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all responded in agreement with DOE's proposal to not include lubricant-free compressors within the scope of test procedure applicability. (CAGI, No. 21 at p. 2; Kaeser Compressors, No. 24 at p. 4; Ingersoll Rand, No. 25 at p. 2; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1)

Kaeser Compressors encouraged DOE to evaluate recently added/verified test standards for oil-free compressors and blowers for potential incorporation in a future rulemaking. Kaeser Compressors also added that, since there are many different compressor and blower technologies in the oil-free category, they may require different ways to develop efficiency and test standards. (Kaeser Compressors, No. 24 at p. 2)

ASAP, ACEEE, & NRDC recommended DOE expand the scope of this test procedure to cover lubricant-free compressors, because including lubricant-free compressors would mitigate the risk of unregulated product substitutions, which was a concern in the January 2017 Final Rule. (ASAP, ACEEE, & NRDC, No. 28 at p. 3)

DOE discussed lubricant-free compressors in both the January 2017 Final Rule (82 FR 1052, 1063) and the January 2020 ECS Final Rule (85 FR 1504, 1519–1520), concluding that justification did not exist at the time to support extending the scope of test procedures or energy conservation standards to apply to lubricant-free compressors. DOE has determined that the conclusion made in the 2017 and 2020 final rules still applies for lubricant-free compressors.

ASAP, ACEEE, & NRDC recommended that DOE mitigate the risk of unregulated product substitutions by expanding the scope of the test procedure to cover lubricant-free compressors and other categories of compressors, such as centrifugal and scroll compressors, instead of excluding lubricant-free compressors. (ASAP, ACEEE, & NRDC, No. 28 at p. 3) Section III.A.2 of this final rule, however, discusses that DOE is continuing to exclude centrifugal compressors from the scope of the test procedure at this time. As a result, in order to ensure that there is not competition between unregulated centrifugal compressors and regulated lubricant-free positive displacement rotary compressors, DOE is also excluding lubricant-free rotary positive displacement compressors from the scope of the test procedure at this time.

For the reasons discussed in the previous paragraphs, at this time, DOE is not expanding the scope of the test procedure to include lubricant-free compressors. DOE may evaluate the justification for developing test procedures for lubricant-free compressors as part of a future rulemaking process.

5. Brushed Motors

As stated in section III.A, the current test procedure for compressors applies only to compressors with brushless motors. 10 CFR 431.344. In the February 2023 NOPR, DOE proposed to not expand the scope of the test procedure to include compressors with brushed motors. 88 FR 9199, 9204. DOE stated that it may evaluate the justification for developing test procedures for compressors with brushed motors as part of a future rulemaking process. DOE also asked for comment regarding its proposal to not include compressors with brushed motors within the scope of test procedure applicability.

In response to the request for comment, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all responded in agreement with DOE's proposal to exclude compressors with brushed motors from the scope of test procedure applicability. (CAGI, No. 21 at p. 2;

Kaeser Compressors, No. 24 at p. 4; Ingersoll Rand, No. 25 at p. 2; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1)

ASAP, ACEEE, & NRDC encouraged DOE to include compressors with brushed motors in the test procedure scope. (ASAP, ACEEE, & NRDC, No. 28 at p. 1) ASAP, ACEEE, & NRDC commented that they were concerned that manufacturers could consider replacing brushless motors with less efficient brushed motors to avoid compressor regulations. (ASAP, ACEEE, & NRDC, No. 28 at p. 3)

DOE discussed compressors with brushed motors in both the January 2017 Final Rule (82 FR 1052, 1060) and the January 2020 ECS Final Rule (85 FR 1504, 1515), concluding that the burden associated with establishing testing requirements for brushed motor compressors outweighed the associated benefits. This was because, although there were potential benefits to expanding scope to include these models, brushed motors are uncommon in compressors with significant operating hours, and most brushed motor compressors are not tested for efficiency. 82 FR 1052, 1060. In addition, DOE stated that brushed motors are uncommon in compressors with significant potential energy savings (*i.e.,* high operating hours) due to higher maintenance costs, short operating lives, significant acoustic noise, and electrical arcing. *Id.* For these reasons, DOE concluded that brushed motors are not a viable substitution risk for compressors within the scope of the DOE compressor test procedure. *Id.*

DOE has determined that the conclusions made in the January 2017 Final Rule still apply for compressors with brushed motors. Due to this reasoning, at this time, DOE is not expanding the scope of the test procedure to include compressors with brushed motors. DOE may evaluate the inclusion of compressors with brushed motors as part of a future rulemaking.

6. Output Pressure Less Than 75 psig

As stated in section III.A, the current test procedure for compressors applies only to compressors that have a full-load operating pressure greater than or equal to 75 psig and less than or equal to 200 psig. 10 CFR 431.344. In the February 2023 NOPR, DOE proposed to not include equipment for compressed air applications for pressures under 75 psig within the scope of test procedure applicability. 88 FR 9199, 9204. DOE stated that it may evaluate the justification for developing test procedures for compressors with output pressure of less than 75 psig as part of a future rulemaking process. *Id.* DOE also asked for comment regarding its proposal to not include equipment for compressed air applications for pressures under 75 psig within the scope of test procedure applicability. *Id.*

In response to the request for comment, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all commented in agreement with DOE's proposal to not include compressors with output pressure less than 75 psig. (CAGI, No. 21 at p. 2; Kaeser Compressors, No. 24 at p. 4; Ingersoll Rand, No. 25 at p. 2; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1)

Kaeser Compressors encouraged DOE to evaluate recently added/verified test standards for oil-free compressors and blowers for potential incorporation in a future rulemaking, which would include pressure ranges of 50–160 psig. Kaeser Compressors added that 1–30 psig is also a large area of energy consumption, which includes wastewater treatment and other aeration and conveying applications that include 24/7 operation. (Kaeser Compressors, No. 24 at p. 2)

At this time, DOE is not expanding the scope of the test procedure to include compressors with output pressure of less than 75 psig. DOE discussed compressors with output pressure of less than 75 psig in both the January 2017 Final Rule (82 FR 1052, 1062–1063) and the January 2020 ECS Final Rule (85 FR 1504,1519), concluding that justification did not exist at the time to support extending the scope of either test procedures or energy conservation standards to apply to compressors with output pressure of less than 75 psig. DOE has determined that the conclusion made in the January 2017 Final Rule and the January 2020 ECS Final Rule still applies for compressors with output pressure of less than 75 psig. DOE may evaluate the justification for developing test procedures for compressors with output pressure of less than 75 psig as part of a future rulemaking process.

7. Integrated Dryers

In response to the February 2023 NOPR, Kaeser Compressors commented that, while integrated dryers inside a compressor package are not listed in the DOE procedure, it might be necessary to specifically exclude them from this test procedure. (Kaeser Compressors, No. 24 at p. 8)

Section 2.2.4 of appendix A contains tables 1 and 2, which specify the compressor components and ancillary equipment that must be present and installed when testing an air compressor. These tables were discussed in the January 2017 Final Rule. 82 FR 1052, 1055–1057, 1080–1082. Table 1 to appendix A contains the equipment that must be present and installed for all tests. If the compressor is distributed in commerce without an item from table 1 to appendix A, the manufacturer must provide an appropriate item to be installed for the test. If any of the equipment listed in table 2 to appendix A is distributed in commerce with units of the compressor basic model, it must be present and installed for all tests specified in appendix A. Additional ancillary equipment beyond the items listed in tables 1 and 2 to appendix A may be installed for the test, if distributed in commerce with the compressor, but this additional ancillary equipment is not required.

Neither table 1 nor table 2 to appendix A specify an integrated dryer, or any type of dryer, as a piece of equipment that must be installed for testing. Table 1 to appendix A specifies a moisture separator and drain, but this is different from a dryer, in that a moisture separator removes liquid water from the air, whereas a dryer removes water vapor from the air. As a result, an integrated dryer is not required to be present and installed for the tests specified in the compressors test procedure. A manufacturer may install an integrated dryer for the tests if the integrated dryer is distributed in commerce with the compressor, but the integrated dryer is not required.

Although Kaeser Compressors suggested that it might be necessary to specifically exclude integrated dryers from the test procedure, DOE is not doing that in this final rule. As discussed in the previous paragraphs, a manufacturer is not required to install an integrated dryer for testing, but the manufacturer may install an integrated dryer if they wish to represent the performance of their compressor with an integrated dryer installed. This flexibility is indicated by the text of section 2.2.4 of appendix A and tables 1 and 2 to appendix A, and no changes are required at this time to clarify this flexibility.

B. Updates to Industry Standards

1. ISO 1217:2009(E) as the Basis for This Test Procedure

DOE's current test procedure incorporates by reference certain sections of ISO 1217:2009(E) as amended through Amendment 1:2016 for test methods and acceptance tests regarding volume rate of flow and power requirements of displacement

compressors, in addition to the operating and testing conditions that apply when a full performance test is specified. In the February 2023 NOPR, DOE did not propose amendments to the existing reference to ISO 1217:2009(E) as amended through Amendment 1:2016 as the basis for the compressors test procedure. 88 FR 9199, 9204–9205. DOE also asked for comment regarding its initial determination to continue to use ISO 1217:2009(E) as amended through Amendment 1:2016 as the basis for the compressors test procedure.

In response to the request for comment, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all commented in agreement with DOE's proposal to continue to use ISO 1217:2009(E) as amended through Amendment 1:2016 as the basis for the compressors test procedure. (CAGI, No. 21 at p. 3; Kaeser Compressors, No. 24 at p. 4; Ingersoll Rand, No. 25 at p. 2; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1)

DOE agrees with the comments received and is continuing to incorporate by reference certain sections of ISO 1217:2009(E) as amended through Amendment 1:2016 in the compressors test procedure at 10 CFR 431.343. As discussed in section III.E.1, DOE is revising 10 CFR 431.343 to add section B.4.5 of Annex B of ISO 1217:2009(E) to the list of sections that DOE is incorporating by reference in the compressors test procedure. *See* section III.E.1 for a full discussion of this revision.

2. Ambient Temperature Range Requirement

DOE adopted the ambient temperature range for testing of 68 to 90 °F in the January 2017 Final Rule partially in response to concern that creating a climate-controlled space for testing compressors could be a significant burden on small businesses. DOE stated that this temperature range provides representative measurements without unduly burdening manufacturers. 82 FR 1052, 1079–1080. In the February 2023 NOPR, DOE proposed to maintain the current ambient temperature range requirement of 68 to 90 °F for testing air compressors. 88 FR 9199, 9205. DOE also asked for comment regarding its proposal to maintain the current ambient temperature range requirement.

In response to the request for comment, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all commented in agreement with DOE's proposal to maintain the current ambient temperature range requirement of 68 to 90 °F for testing air compressors. (CAGI, No. 21 at p. 3; Kaeser Compressors, No. 24 at p. 5; Ingersoll Rand, No. 25 at p. 2; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1) They added that narrowing the range or specifying specific requirements would add burden to the industry without providing any advantages to consumers. (*Id.)*

For the reasons discussed in the February 2023 NOPR and the previous paragraphs, DOE is not amending the current ambient temperature range requirement of 68 to 90 °F for testing air compressors in this final rule.

C. Definitions

1. Multi-Element Air Compressors

Air compressors may include multiple compression elements to increase compression efficiency or to generate a greater pressure increase than would be possible with a single compression element. The current definition of ''air compressor'' specifies inclusion of a compression element but does not exclude air compressors that include more than one compression element. DOE discussed the current definition of ''air compressor'' as applying to multi-element air compressors in both the January 2017 Final Rule (82 FR 1052, 1068) and the January 2020 ECS Final Rule, in which multi-staging was identified as a technology option for improving the energy efficiency of compressors. 85 FR 1504, 1537.

In the February 2023 NOPR, DOE tentatively determined that revising the definition of ''air compressor'' to explicitly include air compressors with more than one compression element would reduce the probability that the definition is misinterpreted to exclude air compressors with more than one compression element. 88 FR 9199, 9205–9206. DOE proposed to amend the definition of ''air compressor'' such that ''compression element (bare compressor)'' is replaced by ''one or more compression elements (bare compressors).'' *Id.* Additionally, DOE proposed to change ''compressor element'' to ''compression elements'' to correct a typographical error. *Id.* DOE also issued a request for comment in the February 2023 NOPR regarding its proposed amendment of the definition of ''air compressor.'' 88 FR 9199, 9206.

In response to the request for comment, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, Sullivan-Palatek, and CA IOUs all expressed support for DOE's proposed amendment to the definition of ''air compressor.'' (CAGI, No. 21 at p. 2; Kaeser Compressors, No. 24 at p. 4; Ingersoll Rand, No. 25 at p. 2; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1; CA IOUs, No. 27 at p. 1)

The current formulation of the definition of ''air compressor'' does not exclude air compressors with more than one compression element; nonetheless, stating expressly that multi-element compressors meet the definition of ''air compressor'' limits the potential for misinterpretation.

For the reasons discussed in the February 2023 NOPR and the preceding paragraphs, DOE is amending the definition of ''air compressor'' to be ''a compressor designed to compress air that has an inlet open to the atmosphere or other source of air, and is made up of one or more compression elements (bare compressors), driver(s), mechanical equipment to drive the compression elements, and any ancillary equipment.''

D. Efficiency Metrics

1. Load Point for Fixed-Speed Compressors

The current efficiency metric for fixed-speed compressors, full-load package isentropic efficiency, uses a single load point at 100 percent of full-load actual volume flow rate. In the February 2023 NOPR, DOE proposed to maintain the requirement to measure the performance of fixed-speed compressors at full load, or more specifically, full-load actual volume flow rate at full-load operating pressure, as described in paragraph 3.3.1 of appendix A. 88 FR 9199, 9209. DOE also asked for comment on whether the test procedure reflects actual operating costs for compressors based on their realistic average use cycles. *Id.*

In response to the February 2023 NOPR, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all expressed support for the provision that the test procedure can be considered reflective of realistic average use cycles. They commented that, in practical terms, no one compressor installation will have identical or predictable use cycles, and that the current regulatory provision to certify fixed-speed machines based on their performance at 100 percent flow rate and for variable-speed machines based on a weighted average for flow conditions provides a realistic, representative framework for testing, certifying, and presenting meaningful and consistent data to customers. (CAGI, No. 21 at p. 5; Kaeser Compressors, No. 24 at p. 8; Ingersoll Rand, No. 25 at p. 4; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1)

For the reasons discussed in the February 2023 NOPR and preceding paragraphs, DOE is not proposing to alter the current metric for fixed-speed compressors in this test procedure final rule.

2. Load Points for Variable-Speed Compressors

The part-load package isentropic efficiency metric for variable-speed air compressors uses three load points: 40, 70, and 100 percent of full-load actual volume flow rate. In the February 2023 NOPR, DOE proposed to continue using those load points. 88 FR 9199, 9208–9209. DOE requested comment on its proposal to maintain the number of load points for variable-speed air compressors and to not include points with greater than 100 percent of full-load actual volume flow rate. *Id.*

In response to the request for comment in the February 2023 NOPR, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all expressed support for the DOE proposal to maintain the number of test points and to not include points with greater than 100-percent load.

For the reasons discussed in the February 2023 NOPR and the previous paragraphs, in this final rule, DOE is maintaining the load points for the part-load package isentropic efficiency metric for variable-speed air compressors at 100 percent, 70 percent, and 40 percent of full-load actual volume flow rate.

3. Inclusion of Unloaded Operation for Fixed-Speed Compressors

The isentropic efficiency metric for fixed-speed compressors currently includes performance at full-load operation only. No measure of performance is included from unloaded operation. In the February 2023 NOPR, DOE proposed to maintain this exclusion of unloaded operation from the isentropic efficiency metric. 88 FR 9199, 9208.

ASAP, ACEEE, & NRDC encouraged DOE to explore how unloaded power measurements could be incorporated into the test procedure. ASAP, ACEEE, & NRDC stated that fixed-speed air compressors are tested and evaluated only at full load. However, they elaborated that fixed-speed compressors often include controls such as ''load/unload'' or ''start/stop'' and commented that testing and evaluating fixed-speed compressor efficiency at both fully loaded and fully unloaded (*i.e.,* zero flow) conditions would be more representative of typical usage. ASAP, ACEEE, & NRDC further stated that the CAGI Performance Verification Program already specifies testing at a fully unloaded test point, and that capturing differences in unloaded power usage will become increasingly important as compressor efficiencies improve. (ASAP, ACEEE, & NRDC, No. 28 at p. 3)

NEEA & NPCC recommended that DOE include a no-load power measurement in the test procedure for fixed-speed compressors that use start/stop and load/unload control strategies. NEEA & NPCC stated that unlike variable-airflow controls, fixed-speed air compressors that use start/stop and load/unload control strategies operate at either fully loaded or fully unloaded states, and testing units that have start/stop or load/unload control strategies at fully loaded and fully unloaded states would be more representative of typical usage. NEEA & NPCC commented that the January 2020 ECS Final Rule indicates that a significant portion of annual energy consumption is spent in a no-load or fully unloaded state for fixed-speed compressors with unload strategies. NEEA & NPCC further stated that, because the metric does not currently account for a no-load power, DOE can't consider technologies that reduce no-load power consumption in its standard analysis; manufacturers that develop products that use less energy in no-load are not given credit in their regulated ratings; and the DOE test procedure assumption for non-operating hours is zero, which is not in agreement with the analysis performed in the January 2020 ECS Final Rule and does not align with the typical usage of compressors. NEEA & NPCC also stated that standby mode and off mode energy consumption measurements are required for all consumer products' test procedures, and that including a no-load power measurement for industrial equipment that consumes power in a no-load state, such as start/stop and load/unload compressors, ensures consistency in test procedure requirements across industrial and consumer products. (NEEA & NPCC, No. 26 at pp. 5–6)

NEEA & NPCC disagreed with DOE's statement in the February 2023 NOPR that testing at a no-load state is not an essential output of the test procedure and, therefore, would cause unneeded incremental burden on testing and reporting requirements. NEEA & NPCC stated that DOE requiring testing at a no-load state is the necessary step for no-load power measurement to be an essential output of the test procedure. NEEA & NPCC also stated that the incremental burden of testing a unit at a no-load state is minimal, as units under test are already set up for testing at specified load points and the CAGI data sheets already specify tolerances for testing at a fully unloaded test point. (NEEA & NPCC, No. 26 at p. 6)

DOE agrees that information describing unloaded states of operation could be useful to the end user. This subject was discussed in the January 2017 Final Rule. 82 FR 1052, 1068–1070. This included mention of possible methods to include loaded and unloaded points in a representative manner, including, potentially, the energy required during the transient periods between loaded and unloaded operation. *Id.* At the time, it was noted that there were no methods that had been developed and accepted by industry consensus, although Atlas Copco did provide an example of a cycle energy requirement approach to consider the energy during loaded operation, unloaded operation, and the transient periods between loaded and unloaded operation. *Id.* At the time, DOE did not include unloaded performance in its isentropic efficiency metric because there was no accepted industry test method. *Id.* DOE indicated at the time that DOE may consider incorporating such a method in future rulemakings if the metric gains acceptance in the industry and the test method can be formalized and validated beyond a case study. 82 FR 1052, 1069. DOE also stated that manufacturers may measure and advertise unloaded power, but it would not require measurement of unloaded performance as part of the test procedure. 82 FR 1052, 1070.

At the current time, DOE is not aware that an industry standard test method has been developed to provide a representative measure of performance across loaded and unloaded operation. In a comment in response to the February 2023 NOPR, Kaeser Compressors indicated that DOE could consider new industrial standards for a future rulemaking, including ISO 4376, Cycle energy requirement.[6] This standard is described on the ISO website as measuring the additional energy required for a single cycle caused by transient conditions, which sounds similar to the method from Atlas Copco that was discussed in the January 2017 Final Rule. The standard is currently listed as ''under development'' on the ISO website, and DOE is not aware of any compressors that are currently rated using this standard. As a result, it appears that this standard is not currently being used widely by industry. DOE is also not aware of any other industry consensus method to

[6] Available at *iso.org/standard/85352.html.*

combine loaded and unloaded performance.

The concerns that existed in the January 2017 Final Rule regarding the lack of an accepted industry test method to combine loaded and unloaded performance still exist. As a result, DOE is not including any measure of unloaded performance in the metrics of the compressors test procedure at this time, although manufacturers may measure and advertise unloaded power. DOE may consider including unloaded performance in the metrics of the compressors test procedures as part of a future rulemaking process.

4. Part-Load Performance of Fixed-Speed Compressors With Variable-Airflow Controls

The isentropic efficiency metric for fixed-speed compressors includes performance at full-load operation only. No measure of performance is included from part-load operation. In the February 2023 NOPR, DOE proposed to maintain this exclusion of part-load operation from the isentropic efficiency metric for fixed-speed compressors. 88 FR 9199, 9208.

ASAP, ACEEE, & NRDC encouraged DOE to include voluntary testing and reporting of part-load performance of fixed-speed compressors with variable-airflow controls. ASAP, ACEEE, & NRDC stated that fixed-speed compressors sold with variable-airflow controls, such as ''variable displacement'' or ''inlet modulation,'' can provide similar utility as variable-speed compressors. Thus, ASAP, ACEEE, & NRDC stated that DOE should provide specific voluntary provisions to test and rate compressors with variable-airflow controls (*e.g.,* using the variable-speed compressor test points at 40, 70, and 100 percent of full load). ASAP, ACEEE, & NRDC further stated that part-load testing of fixed-speed compressors with airflow controls would facilitate comparison of part-load efficiency among variable-airflow compressors as well as between variable-airflow and variable-speed compressors. Finally, ASAP, ACEEE, & NRDC indicated that these provisions would also ensure that any manufacturer representations of variable-airflow compressor part-load performance are consistent across the industry. (ASAP, ACEEE, & NRDC, No. 28 at pp. 3–4)

NEEA & NPCC recommended DOE coordinate with CAGI in rating fixed-speed rotary compressors with variable-airflow controls at variable load points to align with variable-speed compressors. NEEA & NPCC stated that many fixed-speed rotary compressors have variable-airflow controls and non-flat load profiles. Fixed-speed compressors that use variable-airflow controls, such as inlet valve modulation and variable displacement, provide the same function as variable-speed compressors; however, these compressors are tested only at full-load operation currently. Testing fixed-speed rotary compressors with variable-airflow controls at variable load points would be more representative of typical usage and produce a more representative isentropic efficiency. Furthermore, NEEA & NPCC stated that by not testing compressors with variable-airflow controls at part-load set points, consumers cannot compare and select the most efficient air compressors for part-load operations. (NEEA & NPCC, No. 26 at p. 4)

NEEA & NPCC disagreed with DOE's reasoning in the February 2023 NOPR that because fixed-speed rotary compressors in the CAGI data sheets are rated at only full-load isentropic efficiency, establishing part-load isentropic efficiencies for compressors with variable-airflow controls in the test procedure is not warranted at this time. NEEA & NPCC stated that DOE should consider improvements to the testing of variable-airflow compressors for several reasons. First, NEEA & NPCC stated that DOE is not limited to CAGI's performance verification program or the information on CAGI data sheets in their test procedure, and that DOE should fully consider the burden and value of changes to the testing of fixed-speed variable-airflow compressors. Second, NEEA & NPCC commented that the January 2020 ECS Final Rule indicated that about 37 percent of fixed-speed industrial air compressors use inlet valve modulation or variable displacement with high, low, or even load profiles, indicating that a significant portion of fixed-speed air compressors are tested in conditions at which they rarely or never operate. Finally, NEEA & NPCC commented that there may be a significant savings opportunity for fixed-speed rotary compressors with variable-airflow controls, and that DOE should investigate the savings opportunity by testing these compressors the same as variable-speed compressors. NEEA & NPCC stated that if significant savings potential is noted, DOE should update testing to better reflect the energy consumption and potential for savings in this equipment. In addition, NEEA & NPCC stated that DOE could also coordinate with CAGI on how to include these reporting requirements in their data sheets so that both continue to align, should DOE make changes. (NEEA & NPCC, No. 26 at p. 6)

DOE agrees that a part-load package isentropic efficiency metric for fixed-speed variable-airflow compressors could acceptably represent the typical energy use of fixed-speed compressors with variable-airflow controls. This subject was discussed in the January 2017 Final Rule. 82 FR 1052, 1072–1073. At the time, it was noted that CAGI was doing preliminary work on developing a method for one of these control methods (variable displacement), but that there was not yet an industry consensus method for measuring the part-load performance of variable-airflow fixed-speed compressors. *Id.* at 82 FR 1073. The lack of an accepted test method was one of the reasons that DOE did not include a part-load package isentropic efficiency metric for fixed-speed variable-airflow compressors in the test procedure. The other reasons included the lack of historical part-load performance data for these compressors and the approach taken by CAGI and the EU Lot 31 draft standard. *Id.* DOE also acknowledged in the January 2017 Final Rule that part-load performance information for these varieties of compressors can provide valuable information for the end user, and that manufacturers of fixed-speed compressors may continue making graphical or numerical representations of package isentropic efficiency and package specific power as functions of flow rate or rotational speed. *Id.*

At the current time, DOE is not aware of an industry consensus method for measuring part-load package isentropic efficiency for fixed-speed variable-airflow compressors, nor is DOE aware of this metric being used widely for this category of compressors. As a result, the concerns that existed in the January 2017 Final Rule regarding the lack of an accepted industry test method still exist. Therefore, DOE is not including any measure of part-load package isentropic efficiency for fixed-speed variable-airflow compressors in the compressors test procedure at this time. DOE may consider part-load package isentropic efficiency for fixed-speed variable-airflow compressors as part of a future rulemaking process.

E. Test Method

1. K6 Correction Factor

ISO 1217:2009(E) contains several correction factors that correct for variables of the environment, process gas, and compressor operation. The K_6 correction factor in ISO 1217:2009(E) is labeled in section 4.1 of ISO 1217:2009(E) as the correction factor for

the isentropic exponent. The DOE test procedure uses only a subset of the correction factors in ISO 1217:2009(E), and it does not use the K_6 correction factor. The DOE test procedure specifies in sections 3.3.2.2, 3.4.3.2, 3.4.4.2, and 3.5 of appendix A to multiply measured power by the K_5 correction factor, which is labeled in section 4.1 of ISO 1217:2009(E) as the correction factor for the inlet pressure, polytropic exponent, and pressure ratio.

In response to the May 2022 RFI, DOE received comments about potentially needing to use the K_6 correction factor in certain situations. CAGI, supported by Kaeser Compressors, commented that if testing is conducted at sites significantly above sea level, use of the K_6 correction factor may be necessary to obtain accurate representative results. (CAGI, No. 11 at p. 2; Kaeser Compressors, No. 17 at p. 1)

In the February 2023 NOPR, DOE explained that DOE had deliberately omitted the K_6 correction factor during the January 2017 Final Rule. 82 FR 1052, 1084; 88 FR 9199, 9206. As listed in the footnotes of the January 2017 Final Rule, the isentropic exponent of air has some limited variability with atmospheric conditions, and DOE adopted a fixed value of 1.400 to align with the EU Lot 31 draft standard's metric calculations. *Id.* As such, DOE did not propose to amend the current fixed value of 1.400 for the isentropic exponent in the February 2023 NOPR. 88 FR 9199, 9206. DOE also asked for comment regarding its initial determination to continue to use a fixed value of 1.400 for the isentropic exponent, as opposed to incorporating a K_6 correction factor. *Id.*

In response to the request for comment, CAGI, supported by Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek, commented in support of DOE's initial determination to continue to use a fixed value of 1.400 for the isentropic exponent of air. However, they added that to ensure results derived from testing at elevation are accurate, the K_6 correction factor is necessary to incorporate both isentropic exponent and pressure ratio. They indicated that is necessary to correct the measured power with both the K_5 and K_6 correction factors in order to correct for inlet pressure and pressure ratio. The DOE test procedure directs that performance be normalized to a reference ambient inlet pressure of 100 kPa, approximately corresponding to an altitude of 364 ft above sea level. CAGI presented a table illustrating that calculated results are incorrect at elevations greater than and less than 364 ft if K_6 is not used. (CAGI, No. 21 at pp. 3–5; Kaeser Compressors, No. 24 at p. 6; Ingersoll Rand, No. 25 at p. 3; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1) The commenters also indicated that correcting the DOE test procedure to include K_6 will reduce burdens and potential burdens for the industry, because currently the DOE test method and its correction deviates from the national consensus standard. They also stated that correcting the procedure will not result in a need to retest and recertify but will ensure that any verification/certification performed at any elevation other than 364 ft or during low- or high-pressure weather events will be correct. (CAGI, No. 21 at pp. 4–5; Kaeser Compressors, No. 24 at pp. 8–9; Ingersoll Rand, No. 25 at pp. 4–5; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1)

After reviewing CAGI's comments and the content of ISO 1217:2009(E), DOE now understands that K_6 is required to calculate package isentropic efficiency and specific power accurately in the DOE test procedure. Although K_5 is labeled as ''correction factor for inlet pressure, polytropic exponent and pressure ratio'' and K_6 is labeled as ''correction factor for isentropic exponent'' in section 4.1 of ISO 1217:2009(E), which appears to be inaccurate. K_5, as determined in section C.4.3.2 of Annex C to ISO 1217:2009(E), appears to correct only for inlet pressure, because it is a ratio of inlet pressures. K_6, as determined in section B.4.5 of Annex B to ISO 1217:2009(E), appears to correct for both the isentropic exponent and pressure ratio, because it contains ratios of isentropic exponents and pressure ratios. In the case of the DOE test procedure, for which a fixed value of 1.400 is used for the isentropic exponent, K_6 will correct for only pressure ratio. For the packaged compressors covered by the DOE test procedure, both inlet pressure and pressure ratio change with elevation and weather conditions. By including the K_5 correction factor but excluding the K_6 correction factor, the DOE test procedure currently corrects for variations in inlet pressure but does not correct for variations in pressure ratio. By including K_6 as well, the DOE test procedure will correct for variations in both inlet pressure and pressure ratio, thereby resulting in more accurate measurements of isentropic efficiency and specific power.

To incorporate the K_6 correction factor, DOE is making the following changes in the DOE test procedure. First, DOE is incorporating by reference section B.4.5 of ISO 1217:2009(E) into subpart T of 10 CFR part 431, which includes equations to calculate the K_6 correction factor: equation B.9 for single-stage displacement compressors with or without cooling and multi-stage compressors without intercooling, and equation B.10 for multi-stage displacement compressors with intercoolers. Second, DOE is revising sections 3.3.2.2, 3.4.3.2, 3.4.4.2, and 3.5 of appendix A to multiply measured power by both K_5 and K_6, instead of only multiplying measured power by K_5.

As indicated by commenters, these changes will make the results of the DOE test procedure more accurate, reduce burden by making the DOE test procedure consistent with the industry test method, and not require any retesting or recertifying.

2. Correction of Pressure Ratio at Full-Load Operating Pressure Formula

Section 3.6 of appendix A specifies a formula for pressure ratio at full-load operating pressure, which is used to classify whether a machine or apparatus qualifies as a compressor, as the definition of ''compressor'' stated in 10 CFR 431.342 states that the machine or apparatus must have a pressure ratio at full-load operating pressure greater than 1.3. Pressure ratio at full-load operating pressure does not factor directly into the measured values of compressor performance.

In response to the May 2022 RFI, DOE received comments noting that there is an apparent error in the formula for pressure ratio. In the February 2023 NOPR, DOE concurred with the commenters that the current formula contains an error, as it both does not match the discussion in the preamble of the January 2017 Final Rule and does not contain terms related to the calculation of pressure ratio at full-load operating pressure. 88 FR 9199, 9207.

The current formula for pressure ratio at full-load operating pressure inadvertently duplicates a formula used in a calculation related to determining a represented value of performance for a compressor basic model from a tested sample of units. Specifically, the current formula of pressure ratio at full-load operating pressure exactly matches the formula for the lower 95-percent confidence limit (''LCL'') of the true test mean divided by 0.95. In the February 2023 NOPR, DOE proposed to change the formula for pressure ratio at full-load operating pressure in section 3.6 of appendix A to rectify this error and reflect the proper pressure ratio at full-load operating pressure equation that will be utilized in the test procedure. The numerator of this proposed formula for pressure ratio incorporated full-load

operating pressure, determined in section 4.3.4 of appendix A (Pa gauge), while the denominator was standard atmospheric pressure, 100 kPa. 88 FR 9199, 9207.

DOE requested comment in the February 2023 NOPR regarding its proposal to correct the equation for pressure ratio at full-load operating pressure. In response, CAGI, supported by Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek, commented in support of DOE's proposal to correct the equation for pressure ratio at full-load operating pressure to amend a previous typographical error. In addition, the commenters noted that pressure ratio must always be calculated in terms of absolute pressure and recommended the addition of 100 kPa to the numerator of the equation to achieve this. (CAGI, No. 21 at p. 4; Kaeser Compressors, No. 24 at p. 7; Ingersoll Rand, No. 25 at p. 4; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1)

DOE evaluated the stakeholders' recommendation to express pressure ratio in terms of absolute pressure and agrees with the proposed solution. ''Absolute pressure'' is defined as pressure relative to a perfect vacuum. In the correction proposed in the February 2023 NOPR, the equation for pressure ratio expresses pressure in terms of gauge pressure in the numerator and absolute pressure in the denominator. 88 FR 9199, 9207. ''Gauge pressure'' is defined as the pressure above atmospheric pressure and has a different reference pressure compared to absolute pressure. For the calculated pressure ratio to be accurate, both the numerator and denominator must be expressed in terms of absolute pressure.

As a result, in this test procedure final rule, DOE is amending the formula for pressure ratio at full-load operating pressure in section 3.6 of appendix A to rectify the typographical error and to adjust the proposed equation so that pressure ratio is calculated in terms of absolute pressure by adding atmospheric pressure of 100 kPa to the numerator. The amended calculation for pressure ratio at full-load operating pressure is shown below in equation 1:

$$PR = \frac{(P_1 + P_{FL})}{P_1}$$

Eq. 1

Where:

PR = pressure ratio at full-load operating pressure;
P_1 = 100 kPa; and
P_{FL} = full-load operating pressure, determined in section 4.3.4 of appendix A to subpart T of part 431 (Pa gauge).

This change has no effect on the scope of compressors subject to the test procedure and does not increase the associated testing burden on manufacturers.

3. Tolerances for Measured Energy Efficiency Values

DOE adopted the tolerances specified in table 1 of ISO 1217:2009(E) in the January 2017 Final Rule in order to align with ISO 1217:2009(E), as amended, to reduce the burden and cost to manufacturers. DOE stated that most manufacturers currently use ISO 1217:2009(E), and with the modifications adopted in the January 2017 Final Rule, the test methods established for compressors are intended to produce results equivalent to those produced historically under ISO 1217:2009(E). 82 FR 1052, 1076. In the February 2023 NOPR, DOE proposed to continue to use the tolerances for measured energy efficiency values specified in ISO 1217:2009(E) and asked for comment regarding this proposal. 88 FR 9199, 9205.

In response to the request for comment, CAGI, Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek all commented in support of DOE's proposal to continue to use the tolerances for measured energy efficiency values specified in ISO 1217:2009(E). (CAGI, No. 21 at p. 3; Kaeser Compressors, No. 24 at p. 5; Ingersoll Rand, No. 25 at p. 2; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1) CAGI stated that uncertainty of measurement and variation in performance as a result of variation in manufacturing needs to be reflected in data presented to consumers, and that tolerances defined in Annex C of ISO 1217:2019 relate only to the verification of the measured parameters by a practical test. *Id.*

For the reasons discussed in the previous paragraphs, DOE is not amending the tolerances for measured energy efficiency values specified in ISO 1217:2009(E).

F. Reporting

Manufacturers, including importers, must use product-specific certification templates to certify compliance to DOE. For compressors, the certification template reflects the general certification requirements specified at 10 CFR 429.12 and the product-specific requirements specified at 10 CFR 429.63. DOE is not amending the product-specific certification requirements for these products at this time.

G. Test Procedure Costs and Harmonization

EPCA requires that test procedures established by DOE not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3)) The following sections discuss DOE's evaluation of estimated costs associated with the amendments included in this final rule.

In this final rule, DOE is amending the test procedure for compressors by: (1) correcting the formula for calculating isentropic efficiency and specific energy consumption of the packaged compressor to the specified pressure ratio by incorporating a K_6 correction factor, (2) updating the formula for pressure ratio at full-load operating pressure currently presented in appendix A to rectify a previous error, and (3) modifying the current definition of ''air compressor'' to clarify that compressors with more than one compression element are still within the scope of this test procedure, and to revise the typographical error of ''compressor element'' to ''compression element.''

1. Amendment To Incorporate K6 Correction Factor

In the February 2023 NOPR, DOE issued a request for comment on the benefits and burdens of the proposed updates to the test procedure for compressors. 88 FR 9199, 9210. In response to DOE's request for comment, regarding DOE's amendment to include a K_6 correction factor, DOE received comments from CAGI, supported by Kaeser Compressors, Ingersoll Rand, Saylor-Beall, and Sullivan-Palatek, stating that this correction will reduce potential burdens for the industry. These commenters commented that,

currently, the DOE test method and its correction deviate from the national consensus standard. These commenters believe this deviation was not intentional, as it provides no benefit and reduces test accuracy. These commenters further stated that the error and deviation are more significant the farther the elevation is from 364 ft. These commenters also stated that error can occur during atmospheric weather events leading to extreme low or high pressure, and that testing that is not performed at the exact rated full-load operating pressure is incorrectly converted to efficiency and specific power in the current DOE test procedure. CAGI elaborated that 100 kPa represents the mean ambient pressure at 111 m (364 ft), and that if lab elevation differs significantly from this level, measurements deriving efficiency will deviate when using the DOE test method. CAGI stated that, using the industry standard correction, the efficiency as measured (with no corrections) is the same exact value as applying K_5 and K_6 factors to correct specific power consumption and deriving isentropic efficiency at the conclusion (as presented in Annex C and Annex H of ISO 1217:2009). CAGI concluded that correcting the test procedure using their recommendations will not result in a need to retest and recertify, but will ensure that any verification/certification performed at any elevation other than 364 ft or during low- or high-pressure events will be correct. (CAGI, No. 21 at pp. 5–6; Kaeser Compressors, No. 24 at pp. 8–9; Ingersoll Rand, No. 25 at pp. 4–5; Saylor-Beall, No. 22 at p. 1; Sullivan-Palatek, No. 23 at p. 1)

DOE agrees with the stakeholder comments that the incorporation of the K_6 correction factor will not add any test burden or associated costs and will only increase the accuracy of efficiency representations in this test procedure. DOE has also determined that this amendment will not require retesting or recertification solely as a result of DOE's adoption of the amendment to the test procedures, since the amendment aligns the test procedure with existing industry practice. Current industry practice is to use the K_6 correction factor to correct for error introduced by non-standard ambient pressures when testing at elevations above or below 364 ft. As such, although the newly incorporated correction factor would alter the final efficiency output of the DOE test procedure for compressors tested at non-standard ambient pressures as compared to the incorrect calculation in the current test procedure, this correction will not result in a need for manufacturers to retest or to update the isentropic efficiency ratings of their compressors because the industry already uses the appropriate correction factor consistent with the existing industry test procedure. This amendment serves to harmonize the DOE test procedure with the existing industry practice for testing compressor efficiency.

DOE does not anticipate any added test burden or associated costs from the amendment incorporating the K_6 correction factor, as: (1) the test method follows accepted industry practice, and (2) representations of compressor efficiency would not need to be updated, since the amendment DOE is adopting in this final rule will align DOE's test procedure with current industry testing practice, making it so manufacturers do not need to retest their models. As any representations are voluntary prior to the compliance date of any energy conservation standards for compressors, there is no direct burden associated with any of the testing requirements adopted in this final rule.

2. Amendment To Update Formula for Pressure Ratio at Full-Load Operating Pressure

The amendment regarding updating the formula for pressure ratio at full-load operating pressure will not impact the representations of compressor energy efficiency/energy use. The definition of a compressor is ''a machine or apparatus that converts different types of energy into the potential energy of gas pressure for displacement and compression of gaseous media to any higher-pressure values above atmospheric pressure and has a pressure ratio at full-load operating pressure greater than 1.3,'' as stated in 10 CFR 431.342. In the test procedure for compressors, the calculation of pressure ratio at full-load operating pressure is only used to determine if a compressor meets the statutory definition of ''compressor'' by ensuring that the pressure ratio at full-load operating pressure is greater than 1.3. As such, this amendment does not impact representations of energy efficiency/energy use, and DOE does not anticipate any added test burden or associated costs for manufacturers stemming from this correction to the compressors test procedure.

3. Amendment To Update Definition of ''Air Compressor''

DOE does not anticipate any added test burden or associated costs from the amendment updating the definition of ''air compressor.'' This amendment serves to clarify that compressors with more than one compression element are still within the scope of this test procedure, and to revise the typographical error of ''compressor element'' to ''compression elements.'' As such, DOE does not anticipate any added test burden or associated costs for compressor manufacturers due to this amendment.

4. Harmonization With Industry Standards

DOE's established practice is to adopt relevant industry standards as DOE test procedures, unless such methodology would be unduly burdensome to conduct or would not produce test results that reflect the energy efficiency, energy use, water use (as specified in EPCA), or estimated operating costs of that product during a representative average use cycle. 10 CFR 431.4; section 8(c) of appendix A of 10 CFR part 430 subpart C. In cases where the industry standard does not meet EPCA statutory criteria for test procedures, DOE will make modifications through the rulemaking process to these standards as the DOE test procedure.

The test procedure for compressors at appendix A is based on, and incorporates by reference, much of ISO 1217:2009(E), ''Displacement compressors—Acceptance tests,'' as amended through Amendment 1:2016. In this final rule, DOE will incorporate by reference section B.4.5 of Annex B of ISO 1217:2009(E) via amendment. The industry standards DOE has incorporated by reference for the test procedure for compressors are located in 10 CFR 431.343.

H. Effective and Compliance Dates

The effective date for the adopted test procedure amendment will be 75 days after publication of this final rule in the **Federal Register**. EPCA prescribes that all representations of energy efficiency and energy use, including those made on marketing materials and product labels, must be made in accordance with an amended test procedure, beginning 180 days after publication of the final rule in the **Federal Register**. (42 U.S.C. 6314(d)(1)) EPCA provides an allowance for individual manufacturers to petition DOE for an extension of the 180-day period if the manufacturer may experience undue hardship in meeting the deadline. (42 U.S.C. 6314(d)(2)) To receive such an extension, petitions must be filed with DOE no later than 60 days before the end of the 180-day period and must detail how the manufacturer will experience undue hardship. (*Id.*)

I. Renumbering of Appendix A

Currently, appendix A is organized using a hierarchy that uses Roman numerals (*i.e.,* ''I, II, III, IV . . .'') for first-level headings, Latin capital letters for second-level headings (*i.e.,* ''A, B, C, D . . .''), and Arabic numerals (*i.e.,* 1, 2, 3 . . .'') for third-level headings.

In this final rule, DOE is revising the numbering hierarchy of appendix A to use only Arabic numerals, consistent with the numbering hierarchy that DOE uses across test procedures for consumer products at 10 CFR part 430, subpart B and for commercial and industrial equipment generally at 10 CFR part 431. For example, the current heading ''I.B.2'' of appendix A is renumbered to ''2.2.2'' (also reflecting the addition of a new section at the beginning of appendix A). This renumbering is for consistency purposes only and does not result in any substantive changes solely as a result of the renumbering.

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866, 13563, and 14094

Executive Order (''E.O.'') 12866, ''Regulatory Planning and Review,'' as supplemented and reaffirmed by E.O. 13563, ''Improving Regulation and Regulatory Review,'' 76 FR 3821 (Jan. 21, 2011) and E.O. 14094, ''Modernizing Regulatory Review,'' 88 FR 21879 (April 11, 2023), requires agencies, to the extent permitted by law, to (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public. DOE emphasizes as well that E.O. 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs (''OIRA'') in the Office of Management and Budget (''OMB'') has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in this preamble, this final regulatory action is consistent with these principles.

Section 6(a) of E.O. 12866 also requires agencies to submit ''significant regulatory actions'' to OIRA for review. OIRA has determined that this final regulatory action does not constitute a ''significant regulatory action'' under section 3(f) of E.O. 12866. Accordingly, this action was not submitted to OIRA for review under E.O. 12866.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of a final regulatory flexibility analysis (FRFA) for any final rule where the agency was first required by law to publish a proposed rule for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19, 2003 to ensure that the potential impacts of its rules on small entities are properly considered during the DOE rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website: *www.energy.gov/gc/office-general-counsel.* DOE reviewed this final rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003.

For manufacturers of compressors, the Small Business Administration (''SBA'') has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. 13 CFR part 121. The size standards are listed by North American Industry Classification System (''NAICS'') code and industry description and are available at *www.sba.gov/document/support-table-size-standards.* Compressor manufacturing is classified under NAICS 333912, ''air and gas compressor manufacturing.'' The SBA sets a threshold of 1,000 employees or less for an entity to be considered a small business in this category. This employment figure is enterprise-wide, encompassing employees at all parent, subsidiary, and sister corporations.

To identify and estimate the number of small business manufacturers of equipment within the scope of this rulemaking, DOE conducted a market survey using available public information. DOE's research involved industry trade association membership directories (including CAGI), individual company and online retailer websites, and market research tools (*e.g.,* Hoovers reports) to create a list of companies that manufacture equipment covered by this rulemaking. DOE additionally reviewed publicly available data, data available through market research tools, and contacted select companies on its list, as necessary, to determine whether they met the SBA's definition of a small business manufacturer. DOE screened out companies that do not offer equipment within the scope of this rulemaking, do not meet the definition of a ''small business,'' or are foreign owned and operated.

DOE identified a total of 12 domestic small businesses manufacturing compressors. However, as previously stated, the amendments adopted in this final rule revise certain definitions and formulas to ensure the clarity and accuracy of existing requirements and procedures, and the amendments harmonize the DOE test procedure with existing industry practices, without requiring manufacturers to retest their compressors. DOE has determined that the adopted test procedure amendments would not impact testing costs otherwise experienced by manufacturers.

Therefore, DOE concludes that the cost effects accruing from the final rule would not have a ''significant economic impact on a substantial number of small entities,'' and that the preparation of a FRFA is not warranted. DOE has submitted a certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of compressors must certify to DOE that their products comply with any applicable energy conservation standards. To certify compliance, manufacturers must first

obtain test data for their products according to the DOE test procedures, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including compressors. (*See generally* 10 CFR part 429.) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement has been approved by OMB under OMB control number 1910–1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

DOE is not amending the certification or reporting requirements for compressors in this final rule. Instead, DOE may consider proposals to amend the certification requirements and reporting for compressors under a separate rulemaking regarding appliance and equipment certification. DOE will address changes to OMB Control Number 1910–1400 at that time, as necessary.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

D. Review Under the National Environmental Policy Act of 1969

In this final rule, DOE establishes test procedure amendments that it expects will be used to develop and implement future energy conservation standards for compressors. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*) and DOE's implementing regulations at 10 CFR part 1021. Specifically, DOE has determined that adopting test procedures for measuring energy efficiency of consumer products and industrial equipment is consistent with activities identified in 10 CFR part 1021, appendix A to subpart D, A5 and A6. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' 64 FR 43255 (August 4, 1999), imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE examined this final rule and determined that it will not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this final rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

Regarding the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, ''Civil Justice Reform,'' 61 FR 4729 (Feb. 7, 1996), imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction. Section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation (1) clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in sections 3(a) and 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this final rule meets the relevant standards of Executive Order 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (''UMRA'') requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a regulatory action resulting in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at *www.energy.gov/gc/office-general-counsel.* DOE examined this final rule according to UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of $100 million or more in any year, so these requirements do not apply.

H. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires Federal agencies to issue a Family Policymaking Assessment for any

proposed rule or policy that may affect family well-being. When developing a Family Policymaking Assessment, agencies must assess whether: (1) the action strengthens or erodes the stability or safety of the family and, particularly, the marital commitment; (2) the action strengthens or erodes the authority and rights of parents in the education, nurture, and supervision of their children; (3) the action helps the family perform its functions, or substitutes governmental activity for the function; (4) the action increases or decreases disposable income or poverty of families and children; (5) the proposed benefits of the action justify the financial impact on the family; (6) the action may be carried out by State or local government or by the family; and whether (7) the action establishes an implicit or explicit policy concerning the relationship between the behavior and personal responsibility of youth, and the norms of society. In evaluating the above factors, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment as none of the above factors are implicated. Further, this proposed determination would not have any financial impact on families nor any impact on the autonomy or integrity of the family as an institution.

I. Review Under Executive Order 12630

DOE has determined, under Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights'' 53 FR 8859 (March 18, 1988), that this regulation will not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M–19–15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at *www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf.* DOE has reviewed this final rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OMB, a Statement of Energy Effects for any significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that: (1) is a significant regulatory action under Executive Order 12866, or any successor order, and is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (2) is designated by the Administrator of OIRA as a significant energy action. For any significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use if the regulation is implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

This regulatory action is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as a significant energy action by the Administrator of OIRA. Therefore, it is not a significant energy action, and, accordingly, DOE has not prepared a Statement of Energy Effects.

L. Review Under Section 32 of the Federal Energy Administration Act of 1974

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91; 42 U.S.C. 7101), DOE must comply with section 32 of the Federal Energy Administration Act of 1974, as amended by the Federal Energy Administration Authorization Act of 1977. (15 U.S.C. 788; ''FEAA'') Section 32 essentially provides in relevant part that, where a proposed rule authorizes or requires use of commercial standards, the notice of proposed rulemaking must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Attorney General and the Chairman of the Federal Trade Commission (''FTC'') concerning the impact of the commercial or industry standards on competition.

The modifications to the test procedure for compressors adopted in this final rule incorporate testing methods contained in certain sections of the following commercial standards: ISO 1217:2009(E), as amended through ISO 1217:2009(E)/Amd.1:2016. While this test procedure is not exclusively based on this industry testing standard, some components of the DOE test procedure adopt definitions, test parameters, measurement techniques, and additional calculations from them without amendment. DOE has evaluated these standards and is unable to conclude whether it fully complies with the requirements of section 32(b) of the FEAA (*i.e.,* whether it was developed in a manner that fully provides for public participation, comment, and review.) In the January 2017 Final Rule, DOE consulted with both the Attorney General and the Chairman of the FTC about the impact on competition of using the methods contained in these standards and received no comments objecting to their use. 82 FR 1052, 1099.

M. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this rule before its effective date. The report will state that it has been determined that the rule is not a ''major rule'' as defined by 5 U.S.C. 804(2).

N. Description of Materials Incorporated by Reference

The following standards have not previously been approved for incorporation by reference in subpart T, appendix A, but are incorporated by reference in this final rule on the basis that they are referenced by other standards which had been previously and remain incorporated by reference in subpart T, appendix A.

ISO 1217:2009(E), ''Displacement compressors—Acceptance tests,'' fourth edition, July 1, 2009. ISO 1217:2009(E) specifies methods for acceptance tests regarding volume rate of flow and power requirements of displacement compressors. It also specifies methods for testing liquid-ring type compressors and the operating and testing conditions which apply when a full performance test is specified.

ISO 1217:2009/Amd.1:2016(E), Displacement compressors—Acceptance tests (fourth edition, July 1, 2009), AMENDMENT 1: Calculation of isentropic efficiency and relationship with specific energy, April 15, 2016. ISO 1217:2009/Amd.1.:2016(E) provides a method for the calculation of isentropic efficiency and relationship with specific energy.

ISO 5167–1:2022(E), Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full—Part 1: General principles and

requirements, third edition, June 2022. ISO 5167–1:2022(E) defines terms and symbols and establishes the general principles for methods of measurement and computation of the flow rate of fluid flowing in a conduit by means of pressure differential devices (orifice plates, nozzles, Venturi tubes, cone meters, and wedge meters) when they are inserted into a circular cross-section conduit running full. The standard also specifies the general requirements for methods of measurement, installation and determination of the uncertainty of the measurement of flow rate.

ISO 9300:2022(E), Measurement of gas flow by means of critical flow nozzles, third editions, June 2022. ISO 9300:2022(E) specifies the geometry and method of use (installation in a system and operating conditions) of critical flow nozzles used to determine the mass flow rate of a gas flowing through a system basically without the need to calibrate the critical flow nozzle. It also gives the information necessary for calculating the flow rate and its associated uncertainty.

IEC 60584–1:2013, Thermocouples—Part 1: EMF specifications and tolerances, edition 3.0, August 2013. IEC 60584–1:2013 specifies reference functions and tolerances for letter-designated thermocouples.

IEC 60584–3:2021, Thermocouples—Part 3: Extension and compensating cables—Tolerances and identification system, edition 3.0, February 2021. IEC 60584–3:2021 provides tolerances and an identification system necessary for the measurement of thermocouple circuits.

In this final rule, DOE includes revisions to the regulatory text that contained references to section B.4.5 of Annex B of ISO 1217:2009(E), which was not specifically incorporated by reference before this test procedure final rule.

See **SUPPLEMENTARY INFORMATION** section of this document for availability information of this material.

V. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this final rule.

List of Subjects in 10 CFR Part 431

Administrative practice and procedure, Confidential business information, Energy conservation test procedures, Incorporation by reference, Reporting and recordkeeping requirements.

Signing Authority

This document of the Department of Energy was signed on January 10, 2025, by Jeffrey Marootian, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

Signed in Washington, DC, on January 13, 2025.

Treena V. Garrett,

Federal Register Liaison Officer, U.S. Department of Energy.

For the reasons stated in the preamble, DOE amends part 431 of chapter II of title 10 of the Code of Federal Regulations as set forth below:

PART 431—ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 1. The authority citation for part 431 continues to read as follows:

Authority: 42 U.S.C. 6291–6317; 28 U.S.C. 2461 note.

■ 2. Amend § 431.342 by revising the definition of ''Air compressor'' to read as follows:

§ 431.342 Definitions concerning compressors.

* * * * *

Air compressor means a compressor designed to compress air that has an inlet open to the atmosphere or other source of air, and is made up of one or more compression elements (bare compressors), driver(s), mechanical equipment to drive the compression elements, and any ancillary equipment.

* * * * *

■ 3. Revise § 431.343 to read as follows:

§ 431.343 Materials incorporated by reference.

(a) Certain material is incorporated by reference into this subpart with the approval of the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, the DOE must publish a document in the **Federal Register** and the material must be available to the public. All approved incorporation by reference (IBR) material is available for inspection at DOE and at the National Archives and Records Administration (NARA). Contact DOE at: the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, 1000 Independence Avenue SW, EE–5B, Washington, DC 20024, (202) 586–9127, *Buildings@ee.doe.gov, www.energy.gov/eere/buildings/building-technologies-office.* For information on the availability of this material at NARA, visit *www.archives.gov/federal-register/cfr/ibr-locations.html* or email: *fr.inspection@nara.gov.* The material may be obtained from the sources in paragraphs (b) and (c) of this section:

(b) *IEC.* International Electrotechnical Commission Central Office, 3, rue de Varembé, Case Postale 131, CH–1211 GENEVA 20, Switzerland; + 41 22 919 02 11; *webstore.iec.ch.*

(1) IEC 60584–1:2013, *Thermocouples—Part 1: EMF specifications and tolerances,* editions 3.0, August 2013; IBR approved for appendix A to this subpart.

(2) IEC 60584–3:2021, *Thermocouples—Part 3: Extension and compensating cables—Tolerances and identification system,* edition 3.0, February 2021; IBR approved for appendix A to this subpart.

(c) *ISO.* International Organization for Standardization, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland +41 22 749 01 11, *www.iso.org.*

(1) ISO 1217:2009(E), *Displacement compressors—Acceptance tests,* fourth edition, July 1, 2009; IBR approved for appendix A to this subpart.

(2) ISO 1217:2009/Amd.1:2016(E), *Displacement compressors—Acceptance tests* (fourth edition, July 1, 2009), AMENDMENT 1: *Calculation of isentropic efficiency and relationship with specific energy,* April 15, 2016; IBR approved for appendix A to this subpart.

(3) ISO 5167–1:2022(E), *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full—* Part 1: General principles and requirements, third edition, June 2022; IBR approved for appendix A to this subpart.

(4) ISO 9300:2022(E), *Measurement of gas flow by means of critical flow nozzles,* third edition, June 2022; IBR approved for appendix A to this subpart.

■ 4. Revise appendix A to subpart T to read as follows:

Appendix A to Subpart T of Part 431—Uniform Test Method for Certain Air Compressors.

Note: Prior to July 16, 2025, any representations made with respect to the energy use or efficiency of compressors must be based on testing conducted in accordance with:

(a) The applicable provisions of this appendix as they appeared in this subpart T of part 431 as of January 1, 2023; or

(b) This appendix.

Beginning July 16, 2025, representations with respect to energy use or efficiency of compressors, including compliance certifications, must be based on testing conducted in accordance with this appendix.

1. Incorporation by Reference

DOE incorporated by reference in § 431.343, the entire standard for: IEC 60584–1:2013, IEC 60584–3:2021, ISO 1217:2009(E), ISO 1217:2009/Amd.1:2016(E), ISO 5167–1:2022, and ISO 9300:2022; however, only enumerated provisions of ISO 1217:2009(E) and ISO 1217:2009/Amd.1:2016(E) are applicable to this appendix as listed in section 1. To the extent there is a conflict between the terms or provisions of a referenced industry standard and the CFR, the CFR provisions control.

1.1 ISO 1217:2009(E)

1.1.1 Section 2, Normative references;

1.1.2 Section 3, Terms and definitions;

1.1.3 Section 4, Symbols;

1.1.4 Section 5, Measuring equipment, methods and accuracy (excluding 5.1, 5.5, 5.7, and 5.8);

1.1.5 Section 6, Test procedures: the introductory text to Section 6.2, Test arrangements, paragraphs 6.2(g) and 6.2(h), and Table 1—Maximum deviations from specified values and fluctuations from average readings of this appendix;

1.1.6 Annex B (normative), Simplified acceptance test for bare displacement compressors, Section B.4.5 Comparison with specified values;

1.1.7 Annex C (normative), Simplified acceptance test for electrically driven packaged displacement compressors (excluding C.1.2, C.2.1, C.3, C.4.2.2, C.4.3.1, and C.4.5).

1.2 ISO 1217:2009/Amd.1:2016(E)

1.2.1 Section 3.5.1: isentropic power;

1.2.2 Section 3.6.1: isentropic efficiency;

1.2.3 Annex H (informative), Isentropic efficiency and its relation to specific energy requirement, sections H.2, Symbols and subscripts, and H.3, Derivation of isentropic power.

2. Measurements, Test Conditions, and Equipment Configuration

2.1. Measurement Equipment.

2.1.1. For the purposes of measuring air compressor performance, the equipment necessary to measure volume flow rate, inlet and discharge pressure, temperature, condensate, and packaged compressor power input must comply with the equipment and accuracy requirements specified in sections 5.2, 5.3, 5.4, 5.6, and 5.9 of ISO 1217:2009(E), (including the applicable provisions of IEC 60584–1 and IEC 60584–3, as referenced in section 5.3 of ISO 1217:2009(E) and the applicable provisions of ISO 5167–1 and ISO 9300, as referenced in section 5.6 of ISO 1217:2009(E)) and sections C.2.3 and C.2.4 of Annex C to ISO 1217:2009(E).

2.1.2. Electrical measurement equipment must be capable of measuring true root mean square (RMS) current, true RMS voltage, and real power up to the 40th harmonic of fundamental supply source frequency.

2.1.3. Any instruments used to measure a particular parameter specified in section 2.1.1 of this appendix must have a combined accuracy of ±2.0 percent of the measured value at the fundamental supply source frequency, where combined accuracy is the square root of the sum of the squares of individual instrument accuracies.

2.1.4. Any instruments used to directly measure the density of air must have an accuracy of ±1.0 percent of the measured value.

2.1.5. Any pressure measurement equipment used in a calculation of another variable (*e.g.,*actual volume flow rate) must also meet all accuracy and measurement requirements of section 5.2 of ISO 1217:2009(E).

2.1.6. Any temperature measurement equipment used in a calculation of another variable (*e.g.,*actual volume flow rate) must also meet all accuracy and measurement requirements of section 5.3 of ISO 1217:2009(E).

2.1.7. Where ISO 1217:2009(E) refers to ''corrected volume flow rate,'' the term is deemed synonymous with the term ''actual volume flow rate,'' as defined in section 3.4.1 of ISO 1217:2009(E).

2.2. Test Conditions and Configuration of Unit Under Test

2.2.1. For both fixed-speed and variable-speed compressors, conduct testing in accordance with the test conditions, unit configuration, and specifications of section 6.2 paragraphs (g) and (h) of ISO 1217:2009(E) and sections C.1.1, C.2.2, C.2.3, C.2.4, C.4.1, C.4.2.1, C.4.2.3, and C.4.3.2 of Annex C to ISO 1217:2009(E).

2.2.2. The power supply must:

(a) Maintain the voltage greater than or equal to 95 percent and less than or equal to 110 percent of the rated value of the motor,

(b) Maintain the frequency within ±5 percent of the rated value of the motor,

(c) Maintain the voltage unbalance of the power supply within ±3 percent of the rated values of the motor, and

(d) Maintain total harmonic distortion below 12 percent throughout the test.

2.2.3. Ambient Conditions. The ambient air temperature must be greater than or equal to 68 °F and less than or equal to 90 °F for the duration of testing. There are no ambient condition requirements for inlet pressure or relative humidity.

2.2.4. All equipment indicated in table 1 of this appendix must be present and installed for all tests specified in this appendix. If the compressor is distributed in commerce without an item from table 1 of this appendix, the manufacturer must provide an appropriate item to be installed for the test. Additional ancillary equipment may be installed for the test, if distributed in commerce with the compressor, but this additional ancillary equipment is not required. If any of the equipment listed in table 2 of this appendix is distributed in commerce with units of the compressor basic model, it must be present and installed for all tests specified in this appendix.

TABLE 1—EQUIPMENT REQUIRED DURING TEST

Equipment	Fixed-speed rotary air compressors	Variable-speed rotary air compressors
Driver	Yes	Yes.
Bare compressors	Yes	Yes.
Inlet filter	Yes	Yes.
Inlet valve	Yes	Yes.
Minimum pressure check valve/backflow check valve	Yes	Yes.
Lubricant separator	Yes	Yes.
Air piping	Yes	Yes.
Lubricant piping	Yes	Yes.
Lubricant filter	Yes	Yes.
Lubricant cooler	Yes	Yes.
Thermostatic valve	Yes	Yes.
Electrical switchgear or frequency converter for the driver	Yes	Not applicable.*
Device to control the speed of the driver (*e.g.,* variable speed drive)	Not applicable **	Yes.
Compressed air cooler(s)	Yes	Yes.
Pressure switch, pressure transducer, or similar pressure control device	Yes	Yes.

TABLE 1—EQUIPMENT REQUIRED DURING TEST—Continued

Equipment	Fixed-speed rotary air compressors	Variable-speed rotary air compressors
Moisture separator and drain	Yes	Yes.

* This category is not applicable to variable-speed rotary air compressors.
** This category is not applicable to fixed-speed rotary air compressors.

TABLE 2—EQUIPMENT REQUIRED DURING TEST, IF DISTRIBUTED IN COMMERCE WITH THE BASIC MODEL

Equipment	Fixed-speed rotary air compressors	Variable-speed rotary air compressors
Cooling fan(s) and motors	Yes	Yes.
Mechanical equipment	Yes	Yes.
Lubricant pump	Yes	Yes.
Interstage cooler	Yes	Yes.
Electronic or electrical controls and user interface	Yes	Yes.
All protective and safety devices	Yes	Yes.

2.2.5. The inlet of the compressor under test must be open to the atmosphere and take in ambient air for all tests specified in this appendix.

2.2.6. The compressor under test must be set up according to all manufacturer instructions for normal operation (*e.g.,* verify lubricant level, connect all loose electrical connections, close off bottom of unit to floor, cover forklift holes).

2.2.7. The piping connected to the discharge orifice of the compressor must be of a diameter at least equal to that of the compressor discharge orifice to which it is connected. The piping must be straight with a length of at least 6 inches.

2.2.8. Transducers used to record compressor discharge pressure must be located on the discharge piping between 2 inches and 6 inches, inclusive, from the discharge orifice of the compressor. The pressure tap for transducers must be located at the highest point of the pipe's cross section.

3. Determination of Package Isentropic Efficiency, Package Specific Power, and Pressure Ratio at Full-Load Operating Pressure

3.1 Data Collection and Analysis.

3.1.1. Stabilization. Record data at each load point under steady-state conditions. Steady-state conditions are achieved when a set of two consecutive readings taken at least 10 seconds apart and no more than 60 seconds apart are within the maximum permissible fluctuation from the average (of the two consecutive readings), as specified in table 1 of ISO 1217:2009(E) for—

(a) Discharge pressure;

(b) Temperature at the nozzle or orifice plate, measured per section 5.3 of ISO 1217:2009(E); and

(c) Differential pressure over the nozzle or orifice plate, measured per section 5.2 of ISO 1217:2009(E).

3.1.2. Data Sampling and Frequency. At each load point, record a minimum set of 16 unique readings, collected over a minimum time of 15 minutes. Each consecutive reading must be no more than 60 seconds apart, and not less than 10 seconds apart. All readings at each load point must be within the maximum permissible fluctuation from average specified in table 1 of ISO 1217:2009(E) for—

(a) Discharge pressure;

(b) Temperature at the nozzle or orifice plate, measured per section 5.3 of ISO 1217:2009(E); and

(c) Differential pressure over the nozzle or orifice plate, measured per section 5.2 of ISO 1217:2009(E).

If one or more readings do not meet the requirements, then all previous readings must be disregarded and a new set of at least 16 new unique readings must be collected over a minimum time of 15 minutes. Average the readings to determine the value of each parameter to be used in subsequent calculations.

3.1.3. Calculations and Rounding. Perform all calculations using raw measured values. Round the final result for package isentropic efficiency to the thousandth (*i.e.,* 0.001), for package specific power in kilowatts per 100 cubic feet per minute to the nearest hundredth (*i.e.,* 0.01), for pressure ratio at full-load operating pressure to the nearest tenth (*i.e.,* 0.1), for full-load actual volume flow rate in cubic feet per minute to the nearest tenth (*i.e.,* 0.1), and for full-load operating pressure in pounds per square inch gauge (psig) to the nearest integer (*i.e.,* 1). All terms and quantities refer to values determined in accordance with the procedures set forth in this appendix for the tested unit.

3.2. Full-Load Operating Pressure and Full-Load Actual Volume Flow Rate

Determine the full-load operating pressure and full-load actual volume flow rate (referenced throughout this appendix) in accordance with the procedures prescribed in section 4 of this appendix.

3.3. Full-Load Package Isentropic Efficiency for Fixed- and Variable-Speed Air Compressors

Use this test method to test fixed-speed air compressors and variable-speed air compressors.

3.3.1. Test unit at full-load operating pressure and full-load volume flow rate according to the requirements established in sections 2, 3.1, and 3.2 of this appendix. Measure volume flow rate and calculate actual volume flow rate in accordance with section C.4.2.1 of Annex C to ISO 1217:2009(E) with no corrections made for shaft speed. Measure discharge gauge pressure and packaged compressor power input. Measured discharge gauge pressure and calculated actual volume flow rate must be within the deviation limits for discharge pressure and volume flow rate specified in tables C.1 and C.2 of Annex C to ISO 1217:2009(E), where full-load operating pressure and full-load actual volume flow rate (as determined in section 4 of this appendix) are the targeted values.

3.3.2. Calculate the package isentropic efficiency at full-load operating pressure and full-load actual volume flow rate (full-load package isentropic efficiency, $\eta_{isen,FL}$) using the equation for isentropic efficiency in section 3.6.1 of ISO 1217:2009(E) as modified by ISO 1217:2009/Amd.1:2016(E). For $P_{isen,}$ use the isentropic power required for compression at full-load operating pressure and full-load actual volume flow rate, as determined in section 3.3.2.1 of this appendix. For $P_{real,}$ use the real packaged compressor power input at full-load operating pressure and full-load actual volume flow rate, as determined in section 3.3.2.2 of this appendix.

3.3.2.1. Calculate the isentropic power required for compression at full-load operating pressure and full-load actual volume flow rate using equation (H.6) of Annex H to ISO 1217:2009/Amd.1:2016(E). For $q_{V1,}$ use the actual volume flow rate (cubic meters per second) calculated in section 3.3.1 of this appendix. For $p_{1,}$ use 100 kPa. For $p_{2,}$ use the sum of

(a) 100 kPa, and

(b) The measured discharge gauge pressure (Pa) from section 3.3.1 of this appendix. For *K,* use the isentropic exponent (ratio of specific heats) of air, which, for the purposes of this test procedure, is 1.400.

3.3.2.2. Calculate real packaged compressor power input at full-load operating pressure and full-load actual volume flow rate using the following equation:

$$P_{real,100\%} = K_5 \cdot K_6 \cdot P_{PR,100\%}$$

Where:

K_5 = correction factor for inlet pressure, as determined in section C.4.3.2 of Annex C to ISO 1217:2009(E). For calculations of this variable use a value of 100 kPa for contractual inlet pressure;

K_6 = correction factor for pressure ratio, as determined in section B.4.5 of Annex B to ISO 1217:2009(E). For calculations of this variable use a value of 1.400 for isentropic exponent, and for contractual pressure ratio, use the ratio of (a) The sum of 100 kPa and the measured discharge gauge pressure (kPa) from section 3.3.1 of this appendix, to

(b) 100 kPa; and

$P_{PR,100\%}$ = packaged compressor power input reading at full-load operating pressure and full-load actual volume flow rate measured in section 3.3.1 of this appendix (W).

3.4. Part-Load Package Isentropic Efficiency for Variable-Speed Air Compressors

Use this test method to test variable-speed air compressors.

3.4.1. Test unit at two load points:

(a) Full-load operating pressure and 70 percent of full-load actual volume flow rate and

(b) Full-load operating pressure and 40 percent of full-load actual volume flow rate, according to the requirements established in sections 2, 3.1, and 3.2 of this appendix. To reach each specified load point, adjust the speed of the driver and the backpressure of the system. For each load point, measure volume flow rate and calculate actual volume flow rate in accordance with section C.4.2.1 of Annex C to ISO 1217:2009(E), with no corrections made for shaft speed. For each load point, measure discharge gauge pressure and packaged compressor power input. Measured discharge gauge pressure and calculated actual volume flow rate must be within the deviation limits for discharge pressure and volume flow rate specified in tables C.1 and C.2 of Annex C to ISO 1217:2009(E).

3.4.2. For variable-speed compressors, calculate the part-load package isentropic efficiency using the following equation:

$$\eta_{isen,PL} = \omega_{40\%} \times \eta_{isen,40\%} + \omega_{70\%} \times \eta_{isen,70\%} + \omega_{100\%} \times \eta_{isen,100\%}$$

Where:

$\eta_{isen,PL}$ = part-load package isentropic efficiency for a variable-speed compressor;

$\eta_{isen,100\%}$ = package isentropic efficiency at full-load operating pressure and 100 percent of full-load actual volume flow rate, as determined in section 3.3.2 of this appendix;

$\eta_{isen,70\%}$ = package isentropic efficiency at full-load operating pressure and 70 percent of full-load actual volume flow rate, as determined in section 3.4.3 of this appendix;

$\eta_{isen,40\%}$ = package isentropic efficiency at full-load operating pressure and 40 percent of full-load actual volume flow rate, as determined in section 3.4.4 of this appendix;

$\omega_{40\%}$ = weighting at 40 percent of full-load actual volume flow rate and is 0.25;

$\omega_{70\%}$ = weighting at 70 percent of full-load actual volume flow rate and is 0.50; and

$\omega_{100\%}$ = weighting at 100 percent of full-load actual volume flow rate and is 0.25.

3.4.3. Calculate package isentropic efficiency at full-load operating pressure and 70 percent of full-load actual volume flow rate using the equation for isentropic efficiency in section 3.6.1 of ISO 1217:2009(E) as modified by ISO 1217:2009/Amd.1:2016(E). For $P_{isen,}$ use the isentropic power required for compression at full-load operating pressure and 70 percent of full-load actual volume flow rate, as determined in section 3.4.3.1 of this appendix. For $P_{real,}$ use the real packaged compressor power input at full-load operating pressure and 70 percent of full-load actual volume flow rate, as determined in section 3.4.3.2 of this appendix.

3.4.3.1. Calculate the isentropic power required for compression at full-load operating pressure and 70 percent of full-load actual volume flow rate using equation (H.6) of Annex H to ISO 1217:2009/Amd.1:2016(E). For $q_{V1,}$ use actual volume flow rate (cubic meters per second) at full-load operating pressure and 70 percent of full-load actual volume flow rate, as calculated in section 3.4.1 of this appendix. For $p_{1,}$ use 100 kPa. For $p_{2,}$ use the sum of

(a) 100 kPa, and

(b) Discharge gauge pressure (Pa) at full-load operating pressure and 70 percent of full-load actual volume flow rate, as calculated in section 3.4.1 of this appendix. For *K,* use the isentropic exponent (ratio of specific heats) of air, which, for the purposes of this test procedure, is 1.400.

3.4.3.2. Calculate real packaged compressor power input at full-load operating pressure and 70 percent of full-load actual volume flow rate using the following equation:

$$P_{real,70\%} = K_5 \cdot K_6 \cdot P_{PR,70\%}$$

Where:

K_5 = correction factor for inlet pressure, as determined in section C.4.3.2 of Annex C to ISO 1217:2009(E). For calculations of this variable use a value of 100 kPa for contractual inlet pressure;

K_6 = correction factor for pressure ratio, as determined in section B.4.5 of Annex B to ISO 1217:2009(E). For calculations of this variable use a value of 1.400 for isentropic exponent, and for contractual pressure ratio, use the ratio of

(a) The sum of 100 kPa and the measured discharge gauge pressure (kPa) from the test at 70 percent of full-load actual volume flow rate in section 3.4.1 of this appendix, to

(b) 100 kPa; and

$P_{PR,70\%}$ = packaged compressor power input reading at full-load operating pressure and 70 percent of full-load actual volume flow rate, as measured in section 3.4.1 of this appendix (W).

3.4.4. Calculate package isentropic efficiency at full-load operating pressure and 40 percent of full-load actual volume flow rate using the equation for isentropic efficiency in section 3.6.1 of ISO 1217:2009(E) as modified by ISO 1217:2009/Amd.1:2016(E). For $P_{isen,}$ use the isentropic power required for compression at full-load operating pressure and 40 percent of full-load actual volume flow rate, as determined in section 3.4.4.1 of this appendix. For $P_{real,}$ use the real packaged compressor power input at full-load operating pressure and 40 percent of full-load actual volume flow rate, as determined in section 3.4.4.2 of this appendix.

3.4.4.1. Calculate the isentropic power required for compression at full-load operating pressure and 40 percent of full-load actual volume flow rate using equation (H.6) of Annex H to ISO 1217:2009/Amd.1:2016(E). For $q_{V1,}$ use actual volume flow rate (cubic meters per second) at full-load operating pressure and 40 percent of full-load actual volume flow rate, as calculated in section 3.4.1 of this appendix. For $p_{1,}$ use 100 kPa. For $p_{2,}$ use the sum of

(a) 100 kPa, and

(b) Discharge gauge pressure (Pa) at full-load operating pressure and 40 percent of full-load actual volume flow rate, as calculated in section 3.4.1 of this appendix. For *K,* use the isentropic exponent (ratio of specific heats) of air, which, for the purposes of this test procedure, is 1.400.

3.4.4.2. Calculate real packaged compressor power input at full-load operating pressure and 40 percent of full-load actual volume flow rate using the following equation:

$$P_{real,40\%} = K_5 \cdot K_6 \cdot P_{PR,40\%}$$

Where:

K_5 = correction factor for inlet pressure, as determined in section C.4.3.2 of Annex C to ISO 1217:2009(E). For calculations of this variable use a value of 100 kPa for contractual inlet pressure;

K_6 = correction factor for pressure ratio, as determined in section B.4.5 of Annex B to ISO 1217:2009(E). For calculations of this variable use a value of 1.400 for isentropic exponent, and for contractual pressure ratio, use the ratio of

(a) The sum of 100 kPa and the measured discharge gauge pressure (kPa) from the test at 40 percent of full-load actual volume flow rate in section 3.4.1 of this appendix, to

(b) 100 kPa; and

$P_{PR,40\%}$ = packaged compressor power input reading at full-load operating pressure and 40 percent of full-load actual volume

flow rate, as measured in section 3.4.1 of this appendix (W).

3.5. Determination of Package Specific Power

For both fixed and variable-speed air compressors, determine the package specific power, at any load point, using the equation for specific energy consumption in section C.4.4 of Annex C to ISO 1217:2009(E) and other values measured pursuant to this appendix, with no correction for shaft speed. Calculate P_{Pcorr} in section C.4.4 of Annex C to ISO 1217:2009(E) using the following equation:

$P_{Pcorr} = K_5 \cdot K_6 \cdot P_{PR}$

Where:

K_5 = correction factor for inlet pressure, as determined in section C.4.3.2 of Annex C to ISO 1217:2009(E). For calculations of this variable use a value of 100 kPa for contractual inlet pressure;

K_6 = correction factor for pressure ratio, as determined in section B.4.5 of Annex B to ISO 1217:2009(E). For calculations of this variable use a value of 1.400 for isentropic exponent, and for contractual pressure ratio, use the ratio of

(a) The sum of 100 kPa and the measured discharge gauge pressure (kPa) from the test used to determine the package specific power, to

(b) 100 kPa; and

P_{PR} = packaged compressor power input reading (W), as determined in section C.2.4 of Annex C to ISO 1217:2009(E).

3.6. Determination of Pressure Ratio at Full-Load Operating Pressure

Pressure ratio at full-load operating pressure, as defined in § 431.342, is calculated using the following equation:

$$PR = \frac{(P_1 + P_{FL})}{P_1}$$

Where:

PR = pressure ratio at full-load operating pressure;

P_1 = 100 kPa; and

P_{FL} = full-load operating pressure, determined in section 4.3.4 of this appendix (Pa gauge).

4. Method To Determine Maximum Full-Flow Operating Pressure, Full-Load Operating Pressure, and Full-Load Actual Volume Flow Rate

4.1. Principal Strategy

The principal strategy of this method is to incrementally increase discharge pressure by 2 psig relative to a starting point, and identify the maximum full-flow operating pressure at which the compressor is capable of operating. The maximum discharge pressure achieved is the maximum full-flow operating pressure. The full-load operating pressure and full-load actual volume flow rate are determined based on the maximum full-flow operating pressure.

4.2. Pre-test Instructions

4.2.1. Safety. For the method presented in section 4.3.1 of this appendix, only test discharge pressure within the safe operating range of the compressor, as specified by the manufacturer in the installation and operation manual shipped with the unit. Make no changes to safety limits or equipment. Do not violate any manufacturer-provided motor operational guidelines for normal use, including any restriction on instantaneous and continuous input power draw and output shaft power (*e.g.,* electrical rating and service factor limits).

4.2.2. Adjustment of Discharge Pressure

4.2.2.1. If the air compressor is not equipped, as distributed in commerce by the manufacturer, with any mechanism to adjust the maximum discharge pressure output limit, proceed to section 4.2.3 of this appendix.

4.2.2.2. If the air compressor is equipped, as distributed in commerce by the manufacturer, with any mechanism to adjust the maximum discharge pressure output limit, then adjust this mechanism to the maximum pressure allowed, according to the manufacturer's operating instructions for these mechanisms. Mechanisms to adjust discharge pressure may include, but are not limited to, onboard digital or analog controls, and user-adjustable inlet valves.

4.2.3. Driver speed. If the unit under test is a variable-speed compressor, maintain maximum driver speed throughout the test. If the unit under test is a fixed-speed compressor with a multi-speed driver, maintain driver speed at the maximum speed throughout the test.

4.2.4. Measurements and Tolerances

4.2.4.1. Recording. Record data by electronic means such that the requirements of section 4.2.4.5 of this appendix are met.

4.2.4.2. Discharge Pressure. Measure discharge pressure in accordance with section 5.2 of ISO 1217:2009(E). Express compressor discharge pressure in psig in reference to ambient conditions, and record it to the nearest integer. Specify targeted discharge pressure points in integer values only. The maximum allowable measured deviation from the targeted discharge pressure at each tested point is ±1 psig.

4.2.4.3. Actual Volume Flow Rate. Measure actual volume flow rate in accordance with section C.4.2.1 of Annex C to ISO 1217:2009(E) (where it is called ''corrected volume flow rate'') with no corrections made for shaft speed. Express compressor actual volume flow rate in cubic feet per minute at inlet conditions (cfm).

4.2.4.4. Stabilization. Record data at each tested load point under steady-state conditions, as determined in section 3.1.1 of this appendix.

4.2.4.5. Data Sampling and Frequency. At each load point, record a set of at least two readings, collected at a minimum of 10 seconds apart. All readings at each load point must be within the maximum permissible fluctuation from the average (of the two consecutive readings), as specified in 3.1.2 of this appendix. Average the measurements to determine the value of each parameter to be used in subsequent calculations.

4.2.5 Adjusting System Backpressure. Set up the unit under test so that backpressure on the unit can be adjusted (*e.g.,* by valves) incrementally, causing the measured discharge pressure to change, until the compressor is in an unloaded condition.

4.2.6 Unloaded Condition. A unit is considered to be in an unloaded condition if capacity controls on the unit automatically reduce the actual volume flow rate from the compressor (*e.g.,* shutting the motor off, or unloading by adjusting valves).

4.3. Test Instructions

4.3.1. Adjust the backpressure of the system so the measured discharge pressure is 90 percent of the expected maximum full-flow operating pressure, rounded to the nearest integer, in psig. If the expected maximum full-flow operating pressure is not known, then adjust the backpressure of the system so that the measured discharge pressure is 65 psig. Allow the unit to remain at this setting for 15 minutes to allow the unit to thermally stabilize. Then measure and record discharge pressure and actual volume flow rate at the starting pressure.

4.3.2. Adjust the backpressure of the system to increase the discharge pressure by 2 psig from the previous value, allow the unit to remain at this setting for a minimum of 2 minutes, and proceed to section 4.3.3 of this appendix.

4.3.3. If the unit is now in an unloaded condition, end the test and proceed to section 4.3.4 of this appendix. If the unit is not in an unloaded condition, measure discharge pressure and actual volume flow rate, and repeat section 4.3.2 of this appendix.

4.3.4. Of the discharge pressures recorded under stabilized conditions in sections 4.3.1 through 4.3.3 of this appendix, identify the largest. This is the maximum full-flow operating pressure. Determine the full-load operating pressure as a self-declared value greater than or equal to the lesser of (A) 90 percent of the maximum full-flow operating pressure, or (B) 10 psig less than the maximum full-flow operating pressure.

4.3.5 The full-load actual volume flow rate is the actual volume flow rate measured at the full-load operating pressure. If the self-declared full-load operating pressure falls on a previously tested value of discharge pressure, then use the previously measured actual volume flow rate as the full-load actual volume flow rate. If the self-declared full-load operating pressure does not fall on a previously tested value of discharge pressure, then adjust the backpressure of the system to the self-declared full-load operating pressure and allow the unit to remain at this setting for a minimum of 2 minutes. The measured actual volume flow rate at this setting is the full-load actual volume flow rate.

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DEPARTMENT OF ENERGY

10 CFR Part 431

[EERE–2024–BT–DET–0012]

RIN 1904–AE57

Energy Conservation Program: Commercial Warm Air Furnaces; Final Determination

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Final determination.

SUMMARY: On June 2, 2023, the U.S. Department of Energy (''DOE'' or the ''Department'') published a test procedure final rule which established test procedures for commercial warm air furnaces (''CWAFs''). On August 1, 2023, the Air-Conditioning, Heating, and Refrigeration Institute (''AHRI'') filed a petition for review of the final rule in the United States Court of Appeals for the Fourth Circuit. In a February 6, 2024, order, the Fourth Circuit granted a voluntary remand of the final rule to the Department of Energy (''DOE'') to determine whether establishment of the test procedure for the thermal efficiency two (''TE2'') metric is supported by the specific provisions applicable to CWAFs under the Energy Policy and Conservation Act (''EPCA''). More specifically, DOE agreed in this voluntary remand to not enforce the TE2 test procedure unless and until the Department determines that the TE2 test procedure is consistent with the amended industry test procedure, or determines, supported by clear and convincing evidence, that the amended industry test procedure fails to satisfy the statutory requirements. This document provides DOE's determination that the amended industry test procedure fails to satisfy EPCA's statutory requirements.

DATES: The effective date of July 3, 2023, for the TE2 test procedure is confirmed.

ADDRESSES: The docket for this activity, which includes **Federal Register** notices, comments, and other supporting documents/materials, is available for review at *www.regulations.gov.* All documents in the docket are listed in the *www.regulations.gov* index. However, not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure.

The docket web page can be found at *www.regulations.gov/docket/EERE-2024-BT-DET-0012.* The docket web page contains instructions on how to access all documents, including public comments, in the docket.

For further information on how to review the docket, contact the Appliance and Equipment Standards Program staff at (202) 287–1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov.*

FOR FURTHER INFORMATION CONTACT: Ms. Julia Hegarty, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE–5B, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (240) 597–6737. Email: *ApplianceStandardsQuestions@ee.doe.gov.*

Mr. Pete Cochran, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 586–4798. Email: *Peter.Cochran@hq.doe.gov.*

SUPPLEMENTARY INFORMATION:

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I. Introduction

A. Authority

The Energy Policy and Conservation Act, Public Law 94–163, as amended (''EPCA''),[1] authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317, as codified) Title III, Part C of EPCA, added by Public Law 95–619, title IV, sec. 441(a), established the Energy Conservation Program for Certain Industrial Equipment, which sets forth a variety of provisions designed to improve energy efficiency. This equipment includes CWAFs, the subject of this document. (42 U.S.C. 6311(1)(J)).

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA include definitions (42 U.S.C. 6311), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), energy conservation standards (42 U.S.C. 6313), and the authority to require information and reports from manufacturers (42 U.S.C. 6316; 42 U.S.C. 6296).

The Federal testing requirements consist of test procedures that manufacturers of covered equipment must use as the basis for: (1) certifying to DOE that their equipment complies with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6316(b); 42 U.S.C. 6296), and (2) making other representations about the efficiency of that equipment (42 U.S.C. 6314(d)). Similarly, DOE uses these test procedures to determine whether the equipment complies with relevant standards promulgated under EPCA. DOE's test procedures for CWAFs are currently prescribed at subpart D of part 431 of title 10 of the Code of Federal Regulations (''CFR'').

Federal energy efficiency requirements for covered equipment established under EPCA generally supersede state laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a) and 42 U.S.C. 6316(b); 42 U.S.C.

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116–260 (Dec. 27, 2020), which reflect the last statutory amendments that impact Parts A and A–1 of EPCA.